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THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 78 1999

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LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, or rambling, there is a Section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area and beyond, including records of plants and animals.

The *London Bird Report,* also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and the *Ornithological Bulletin,* are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting localities, both within and outside our Area. These excursions are very popular with beginners wishing to increase their knowledge, and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the Sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

ORDINARY MEMBERS	£15.00
JUNIOR MEMBERS	£5.00
SENIOR MEMBERS	£8.00
FAMILY MEMBERS	£3.00
AFFILIATED SUBSCRIBERS	£15.00

Junior membership is for persons under 18, or under 25 and receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be addressed to:

The Membership Secretary, LNHS,
Ruth Day, 18 Zenoria Street,
London SE22 8HP

THE LONDON NATURALIST

Further copies of this issue of *The London Naturalist* may be obtained (price £6 plus £1 postage and packing in the UK and the Republic of Ireland) from Catherine Schmitt, 4 Falkland Avenue, London N3 1QR. Back numbers of most recent issues of both *The London Naturalist* and *London Bird Report* are also available from the same address. Cheques should be made payable to the London Natural History Society.

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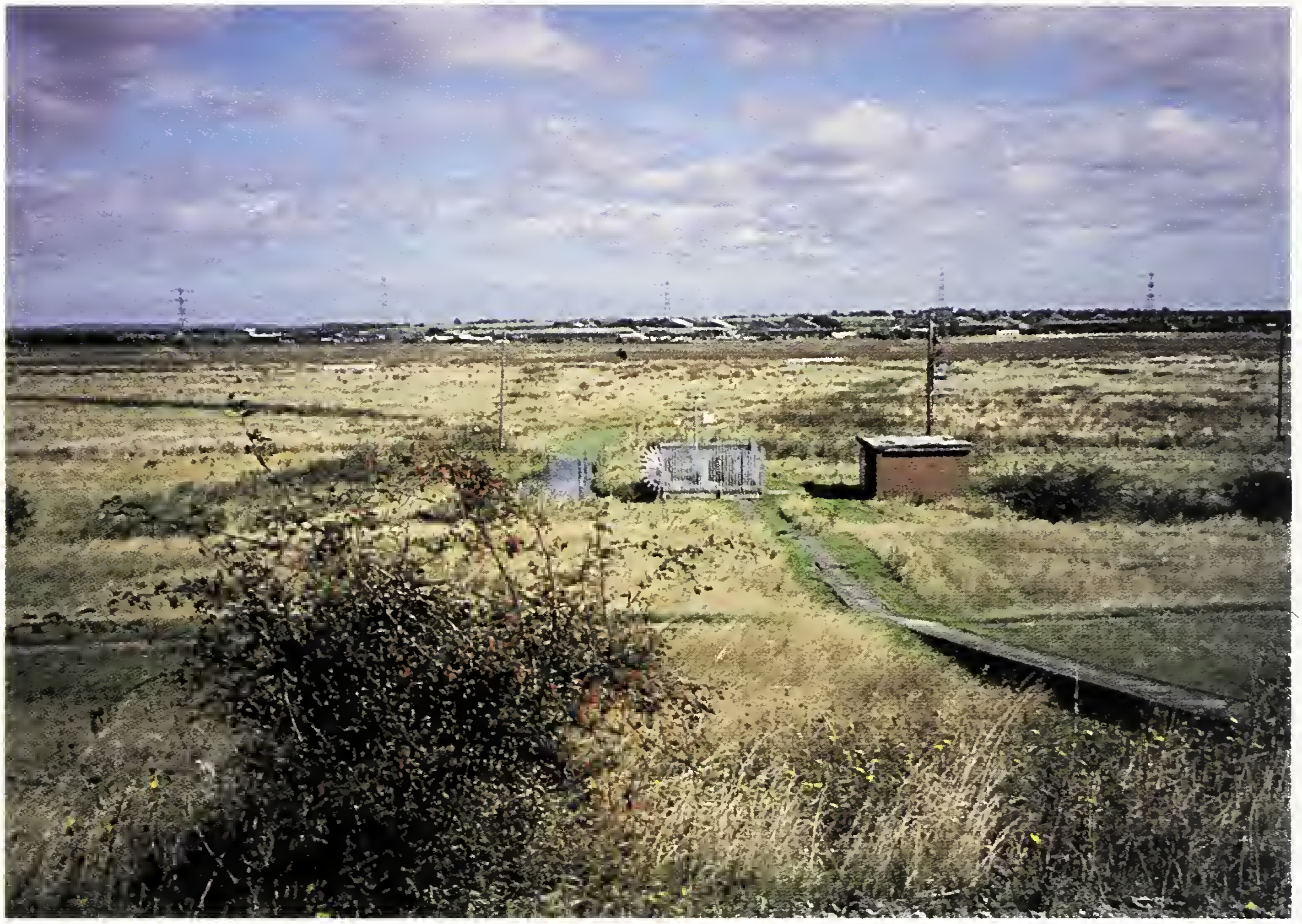

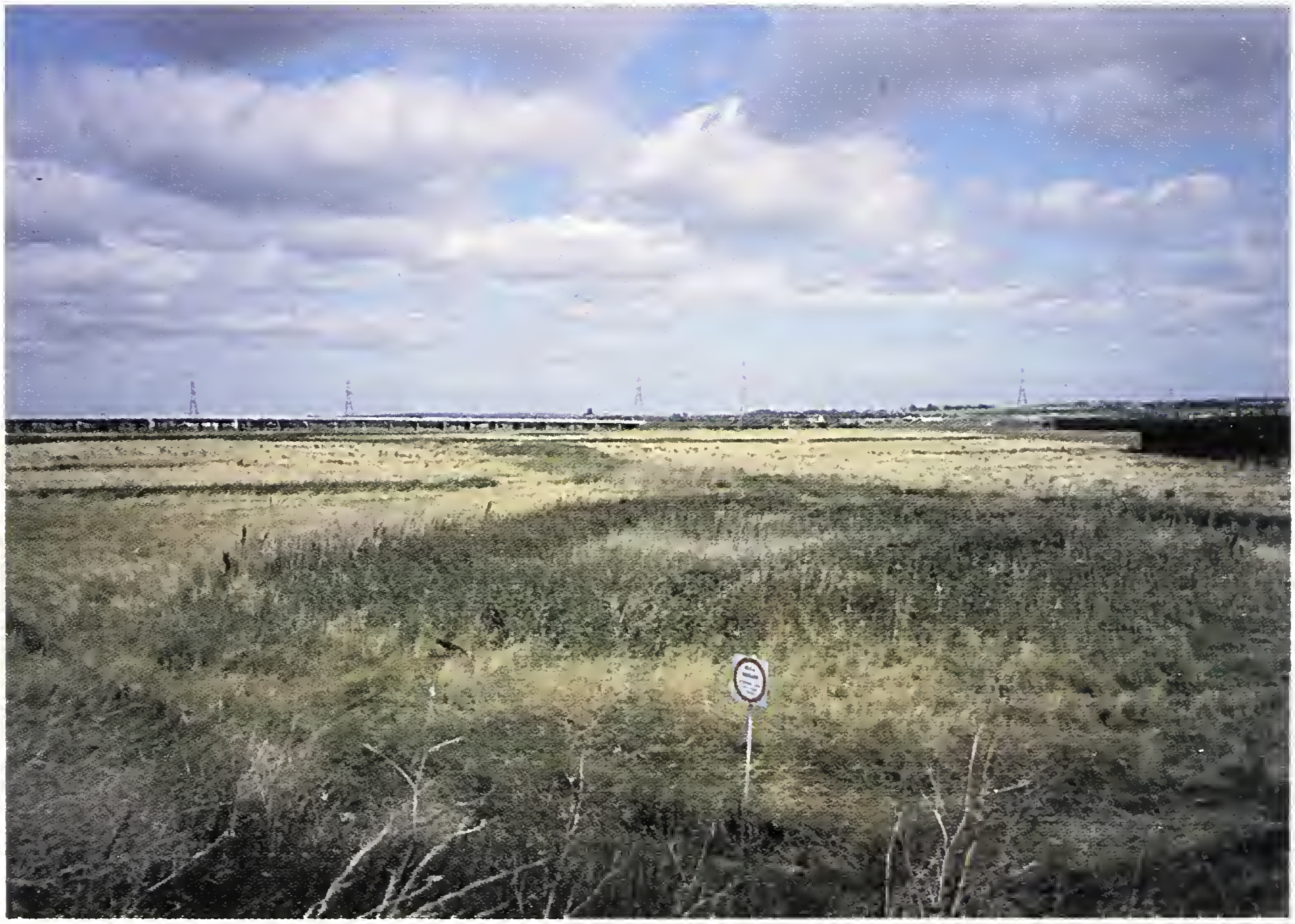

The Inner Thames Marshes SSSI near Rainham, Essex.

Top: Aveley Marsh, in the Borough of Thurrock, is benefiting from water management by the Friends of Rainham Marsh. This is resulting in increasing numbers of winter wetland birds.

Bottom: Wennington Marsh, in the Borough of Havering, is benefiting from renewed conservation grazing and hay cutting which are diversifying the habitat.

Photos: Pat Sellar

THE

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LONDON NATURAL HISTORY SOCIETY

Founded 1858

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Drifts, Chinnor Hill, Oxford OX9 4BS

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Secretary: A. J. Barrett, 21 Green Way, Frinton-on-Sea, Essex CO13 9AL.

Treasurer: M. J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

Membership Secretary: Ms R. Day, 18 Zenoria Street, London SE22 8HP.

Librarian: Mrs L. Hewitt, 106 Hatherley Court, London W2 5RF.

Editor: *The London Naturalist:* K. H. Hyatt, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU.

Co-ordinating Editor: *London Bird Report:* Ms R. Day, 18 Zenoria Street, London SE22 8HP.

Editor: *Newsletter:* Vacant.

Editor: *Ornithological Bulletin:* D. J. Montier, Eyebrook, Oldfield Road, Bickley, Bromley, Kent BR1 2LF.

Elected Members of Council: N. Anderson, Mrs D. L. Brookman, Miss V. S. Harley. Dr J. F. Hewlett, A. J. Leppard, J. M. W. Topp.

Representative Members of Council: Bookham Common Survey — Dr I. S. Menzies; Botany — Dr M. C. Sheahan; Ecology and Entomology — G. W. Loveland; Hampstead Heath Survey — Dr C. Bowlt; Ornithology — Miss N. Duckworth; Ramblers, Archaeology and Geology — Mrs J. R. Lord.

The Society's Recorders

Botany

Flowering plants and vascular cryptogams: R. M. Burton, MA, FLS, Sparepenny Cottage, Sparepenny Lane, Eynsford, Kent DA4 0JJ (01322 863216).

Lichens: Ms Amanda Waterfield, B.SC., 29 Gloucester Crescent, London NW1 7DL (020-7267 8060).

Ecology and Entomology

Mammals: C. Herbert, 67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL (020-8440 6314).

Reptiles and amphibians: T. E. S. Langton, B.SC., 12 Millfield Lane, London N6 6RA (01986 784518).

Fishes: Dr Ruth Kirk, Crucian, PO Box 1051, Kingston on Thames, Surrey KT2 5WX (020-8401 6766).

Arachnida: J. E. D. Milner, B.SC., 80 Weston Park, London N8 9TB (020-8341 2158).

Coleoptera (Carabidae): P. R. Mabbott, B.SC., 49 Endowood Road, Sheffield S7 2LY (0114-201 4504).

Coleoptera (Lucanidae and Buprestidae): Dr D. S. Hackett, FRES, 3 Bryanstone Road, London N8 8TN (020-8292 6134).

Coleoptera (families not otherwise listed): M. Barclay, 47 Tynemouth Street, London SW6 2QS (020-7371 9095).

Lepidoptera, Syrphidae, and invertebrates not otherwise listed): C. W. Plant, B.SC., FRES, 14 West Road, Bishops Stortford, Hertfordshire CM23 3QP (01279 507697).

Orthoptera: Miss S. L. Bain, 232 Brecknock Road, London N19 5BQ (020-7609 0430).

Hymenoptera: R. W. J. Uffen, 4 Mardley Avenue, Welwyn, Hertfordshire AL6 0UD (01438 714968).

Heteroptera: E. W. Groves, 143 Westleigh Avenue, Coulsdon, Surrey CR5 3AF.

Odonata: Ms Ruth Day, B.SC., 18 Zenoria Street, London SE22 8HP (020-8693 4259).

Plant galls: K. Hill, BA, FLS, 93 Elmhurst Drive, Hornchurch, Essex RM11 1NZ (01708 456652).

Mollusca: Vacant.

Records may be sent to the appropriate recorder (where shown) or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Geology

C/o R. E. Butler, B.SC., FGS, 205 Barnett Wood Lane, Ashtead, Surrey KT21 2DF (01372 274103).

Ornithology

Buckinghamshire, Hertfordshire and Inner London: A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR.

Kent and Lower Thames (London Bridge to Tilbury): A. J. Morris, 134 Station Road, Crayford, Kent DA1 3QQ.

Surrey and Upper Thames (Wandsworth to Staines): S. J. Spooner, 32 Berkeley Drive, West Molesey, Surrey KT8 1RA.

Middlesex: C. Lamsdell, 4 Hardings Close, Iver Heath, Buckinghamshire SL0 0HL.

Essex: D. Lambert, 109 Gloucester Road, London E17 6AF.

Requests for information should be made to the appropriate recorder.

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Report of Council, November 1997 to June 1998

Approved at the Annual General Meeting on 8 December 1998

Your Council has decided that in order to be able to conform with the Charities Acts 1992/3 the Society's Activity Year should end on 30 June each year — this decision means that the Report of Council will in future be in conformity with the Financial Statement. The two, when read together, will constitute the Annual Report of the Society.

The period under review has been one of steady if unspectacular activity. Council is, however, very concerned about the number of vacant offices which remain to be filled, and, through its various committees, is still considering how best to implement the changes needed in the structure of the Society, but none of these hoped-for improvements will be of any use unless more people come forward to help the existing overworked officers. The lack of volunteers will, if it continues, soon provoke a real crisis within the organization of the Society.

Membership

We have to record the deaths of J. Farrand, Dr J. Harvey, J.E.M. de Quidt and L.G. Spong. Total paid-up membership of the Society is 1,169 as follows:

Ordinary	863	Junior	7	Honorary	19
Family	96	Senior	146	Life	7

Thirty-one organizations are affiliated to the Society.

The above figures are slightly distorted by the change in reporting period — some members always pay late.

Bearing in mind the increase in the subscription from 1 January 1998 the membership figures must be considered as satisfactory.

Council has appointed the following to be Honorary Members of the Society:

Prof. and Mrs J.W. Landells
A.H.V. Smith
G. Taylor
T.R. Maynard
Mrs M.L. Shattock
C.F. Turner
D.V. Freshwater

Indoor activities

The showing of 'London's Birds' in April was a huge success — some 100 members and friends welcomed the film makers Bill Park and Raymond Cordero. The film had well stood the test of time — for those older members it was an evening of happy remembrances and reunion; for the newer members, an insight of our Society thirty-five years ago was revealed. Pat Sellar did the commentary and Tony Barrett took the chair and did the organizing — we are grateful to both of them.

Sectional meetings continue to be only moderately well attended but much enjoyment and knowledge are being imparted and received.

Conservation

The Nature Conservation Working Group has concentrated its activities on a resurvey of the Beverley Brook in south-west London, previously surveyed in 1988 by David Stubbs on behalf of the London Wildlife Trust for the National Rivers Authority. The current survey, coordinated by Freda Turtle and Jacqueline Shane, will seek to update the original and record any changes that have occurred. This will provide a baseline of data which will be used to monitor any further changes that may occur when the water source for the Brook changes around the year 2000. A series of field meetings has been held to survey specific reaches of the Brook and to initiate new members into the survey. The project is very much a joint endeavour and several other environmental organizations including London Wildlife Trust, Ecology and Conservation Studies Society, Wimbledon and Putney Conservators and London Bat Group have contributed. This is a millennium project with a difference and one to which the Society is making a major contribution.

There is continuing concern over habitat loss and the decline of biological diversity in the capital, but we will continue to provide detailed records, expertise and advice where it is needed. In March, we were represented at a conference on 'Biodiversity in the London Boroughs' hosted by the London Ecology Unit at which individual boroughs were encouraged to develop their own Biodiversity Action Plans. In May, the Conservation Officer represented the Society at a further conference on 'Enhancing Biodiversity in Urban Areas' organized by the South East Region Urban Nature Conservation Forum at which he presented a short paper on 'London's Distinctive Flora'.

Study Centres

Work at Bookham continues but the absence of a secretary for the group does not make the task of organization any easier.

At Hampstead Heath some 10–20 members assemble every last Sunday in the month and additional survey work is being done by individuals at other times. The Open Day on 24 May was well supported. Botanical studies continue — studies which have to take into account the (re)introduction of plants in the Corporation of London's conservation programme. Monitoring the grey squirrel population has so far proved impossible whilst invertebrate recording has been restricted largely to the Lepidoptera.

Library

Forty-four volumes have been added. The Librarian, Linda Hewitt and her predecessor, Joan Hardy have worked to bring the computerized catalogue entries up to 7,000. The database is now closed and the Committee await the appointment of a Society Computer Officer before initiating purchase of a computer for recording current material. The Committee has been re-evaluating its role in the light of present-day needs and technologies. Ideally each Section should have a representative. It is also assessing its journal holdings; a list of titles proposed for withdrawal has been drawn up, which has been circulated to Sections for comment. The Librarian is continuing to fill gaps in files of journals prior to binding as the best method of safekeeping.

A generous bequest of books, journals and videos has been received from the personal library of Roy Alderton for which the Society is much indebted.

The resiting of our Library following extensive renovation and expansion of Imperial College Library is now complete. Members who have not previously used our facilities are recommended to explore the new arrangements; they may find much of use and interest amongst the books and journals now so well displayed.

We thank Linda Hewitt who has worked so hard to develop the service and Joan Hardy for her continued advice and help during the year. For the new accommodation and other facilities we must thank the College Librarian, Mrs Czigány, the Life Sciences Librarian, Linda Dorrington and their staff.

Archives

There was little activity in the Archives during the year. The collection continues to be housed securely but cramped in a very full cupboard in the basement of the Science Library of Imperial College.

The Society's Archives have great potential importance. Our Society has undoubtedly been one of the most successful and influential natural history societies in the country. Hopefully a sesquicentenary history of the Society will be written for publication in 2008. Its history, being that of a major natural history society, if treated in the right way would make a substantial contribution to the study of the development of interest in natural history. It would be relevant to the historic role of the committed and skilled amateur in fostering a climate in which such studies flourished, in Britain as in just a few other countries of the world; and to the emergence of the conservation movement. Work on the history should start as soon as possible, while influential and seminal post-war members might still recollect relevant aspects. The Archive collection will provide an invaluable starting point for both post-war studies and earlier ones. The Society's Archivist would appreciate help from someone with relevant experience and expertise to assist in electronic databasing of the Archives.

All members, officers and others, are urged to consider if they have material relevant for deposition in the Archives. Deciding what to store is difficult, since it is hard to know what might be relevant in the future; obviously documents relating to the Society's own activities, but in principle thought will be given to records of any kind. Who would have thought that starlings would cease to roost in central London over the past decade, apparently unnoticed by anyone except our previous President Colin Bowlt? The Archivist himself recalls seeing a roost, on the girders underneath Wandsworth Bridge on the day he bought a particular second-hand car from an auction nearby, in the autumn of 1980: this record is in the Archives; maybe members have relevant anecdotes such as this. At least, let the Archivist know before data and correspondence of any kind are jettisoned.

Publications

The latest issues of *The London Naturalist* and *London Bird Report* were well received — all members should be grateful to our hard-working editors. Sales of both books and journals have noticeably improved now that there are officers in place to handle sales. Splitting the job between Catherine Schmitt and Tony Barrett has worked well and it is encouraging to record their progress.

The survey work of the gardens at Buckingham Palace is complete although much remains to be considered — publication will not be easy but every avenue will be explored to see that the research data are made public.

The same philosophy applies to the data which it was intended should form the new *Atlas of breeding birds*. This publication is in real difficulty and there is no immediate prospect of the data being available in book form.

Other matters

Copies of the Society's books continue to be donated to institutions and seats of learning. This year your Society was able to send books and journals to the Georgian Centre for the Conservation of Wildlife in Tiblisi.

February 1998 saw the winding-up of the South-West Middlesex Section.

December 1997 saw the end of the two-monthly 'stuffing party' gathering at Imperial College. For many years this group of volunteers folded newsletters, checked addresses and put all manner of journals, programmes and papers into envelopes for distribution to members. Now the mailings are subcontracted out because numbers of volunteers attending were falling and the work was becoming too onerous. So let us end this report by offering the warm thanks of all members to those unsung, chiefly unknown workers without whom our Society simply would not have functioned.

Treasurer's report for 1997/8

At the end of the financial year on 30 June 1998, the total net assets of the Society were £479,549, compared with £436,812 the previous year, representing an increase of nearly 10 per cent.

Income for the year totalled £38,135 compared with £34,812 in 1996/7, due largely to the first subscription increase since 1989. Income from subscriptions (and the tax recoverable in this financial year on covenanted subscriptions for 1997) rose from £11,579 to £15,500. Donations also increased from £307 to £877. Sales income from the Society's various publications rose by nearly 30 per cent to £1,617, with sales of *The London Naturalist* and *London Bird Report* building up again. Demands for the older publications remained steady, and stocks of the *Flora of the London Area* are now almost exhausted. Investment income fell by around eight per cent from £21,480 to £19,780 (net) reflecting economic conditions. However, the market value of the Society's investment portfolio rose from £410,179 to £457,722.

Overall expenditure during the year rose from £38,181 to £46,767, largely because of substantially higher production costs for expanded issues of *The London Naturalist* and *London Bird Report* (£14,100 compared with £9,725, which was the lowest total for several years), and the purchase of new computers. Meetings costs, sectional and general expenditure fell by £1,044 to £7,196, but management and administrative expenses were £1,851 higher at £12,490.

Statement of trustees' responsibilities

Charity law requires the Council as trustees to prepare financial statements for each financial year which give a true and fair view of the state of affairs of the charity and of its financial activities for that period. In preparing those financial statements the trustees are required

- to select suitable accounting policies and then apply them consistently;
- to make judgements and estimates that are reasonable and prudent;
- to state whether applicable accounting standards have been followed subject to any material departures disclosed and explained in the financial statements; and
- to prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue in business.

The trustees are responsible for keeping proper accounting records which disclose with reasonable accuracy at any time the financial position of the charity and to enable them to ensure that the financial statements comply with the Charities Act 1993. They are also responsible for safeguarding the assets of the charity and for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Summarized accounts for the year ended 30 June 1998

These summarized accounts have been extracted from the Society's annual accounts for 1997/8. They may not contain sufficient information to provide a full understanding of the financial affairs of the Society. For further information the full accounts, the auditors' report on these accounts and trustees' annual report should be consulted. Copies can be obtained from the Hon. Treasurer, M.J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

The annual accounts were approved by the trustees on 21 November 1998.

Summarized statement of financial activities for the year ended 30 June 1998

	Unrestricted funds 1998 £	Unrestricted funds 1997 £
Incoming resources		
Subscriptions received from members	15,550	11,579
Interest receivable	311	200
Investment income	19,780	21,480
Publications/journals income	1,617	1,246
Other sundry income (including donations and bequests)	877	307
Total incoming resources	38,135	34,812
Resources expended		
Direct charitable expenditure	34,277	27,542
Management and administrative expenses	12,490	10,639
Total resources expended	46,767	38,181
Net (outgoing)/incoming resources for the year	(8,632)	(3,369)
Gains and losses on investments		
Realized gains on sale of investments	12,667	21,226
Unrealized gains/(losses) on revaluation of investments	38,702	3,932
Net movement in funds	42,737	21,789
Fund balance brought forward at 1 July 1998	436,812	415,023
Fund balance carried forward at 30 June 1998	£479,549	£436,812

Balance Sheet as at 30 June 1998

	1998 £	1997 £
Fixed assets		
Tangible fixed assets for use by charity	2,685	791
Investments at market value: listed	457,722	410,179
cash	20,297	26,021
	480,704	436,991
Net current assets/(liabilities)	(1,155)	(179)
Total net assets	£479,549	£436,812
Represented by:		
Unrestricted funds	£479,549	£436,812

Report of the auditors to the members of the London Natural History Society

We have audited the summary financial statements set out on page 10.

Respective responsibilities of trustees and auditors

The summary financial statements are the responsibility of the trustees. Our responsibility is to report to you our opinion on their preparation and consistency with the full financial statements and Annual Report.

Basis of opinion

We conducted our audit in accordance with Auditing Guideline, *The auditor's statement on the summary financial statement,* adopted by the Auditing Practices Board.

Opinion

In our opinion the summary financial statement is consistent with the full financial statements and Annual Report of the Society for the year ended 30 June 1998.

4 London Wall Buildings
LONDON EC2M 5NT

21 November 1998

FRASER RUSSELL
Chartered Accountants
and Registered Auditors

Official and sectional reports for 1998

CONSERVATION

This year the Nature Conservation Working Group continued the resurvey of the Beverley Brook in south-west London. The Brook was previously surveyed in 1988 by David Stubbs on behalf of the London Wildlife Trust for the National Rivers Authority. The current survey, coordinated by Freda Turtle and Jacqueline Shane, will seek to update the original and record any changes that have occurred. This will provide a baseline of data which will be used to monitor any further changes that may occur when the water source for the Brook changes around the year 2000. At present some 90 per cent of its waters come from the Worcester Park Sewage Treatment Works (Figure 1), but by 2000 it will be provided with outflow water from the more modern Hogsmill STW. A series of field meetings has been held to survey specific reaches of the Brook and to initiate new members into the survey. The project is very much a joint endeavour and several other environmental organizations have contributed. These include the London Wildlife Trust, the Ecology and Conservation Studies Society, the Putney Society, the Wimbledon and Putney Conservators and the London Bat Group. This is a millennium project with a difference and one to which the Society is making a major contribution.

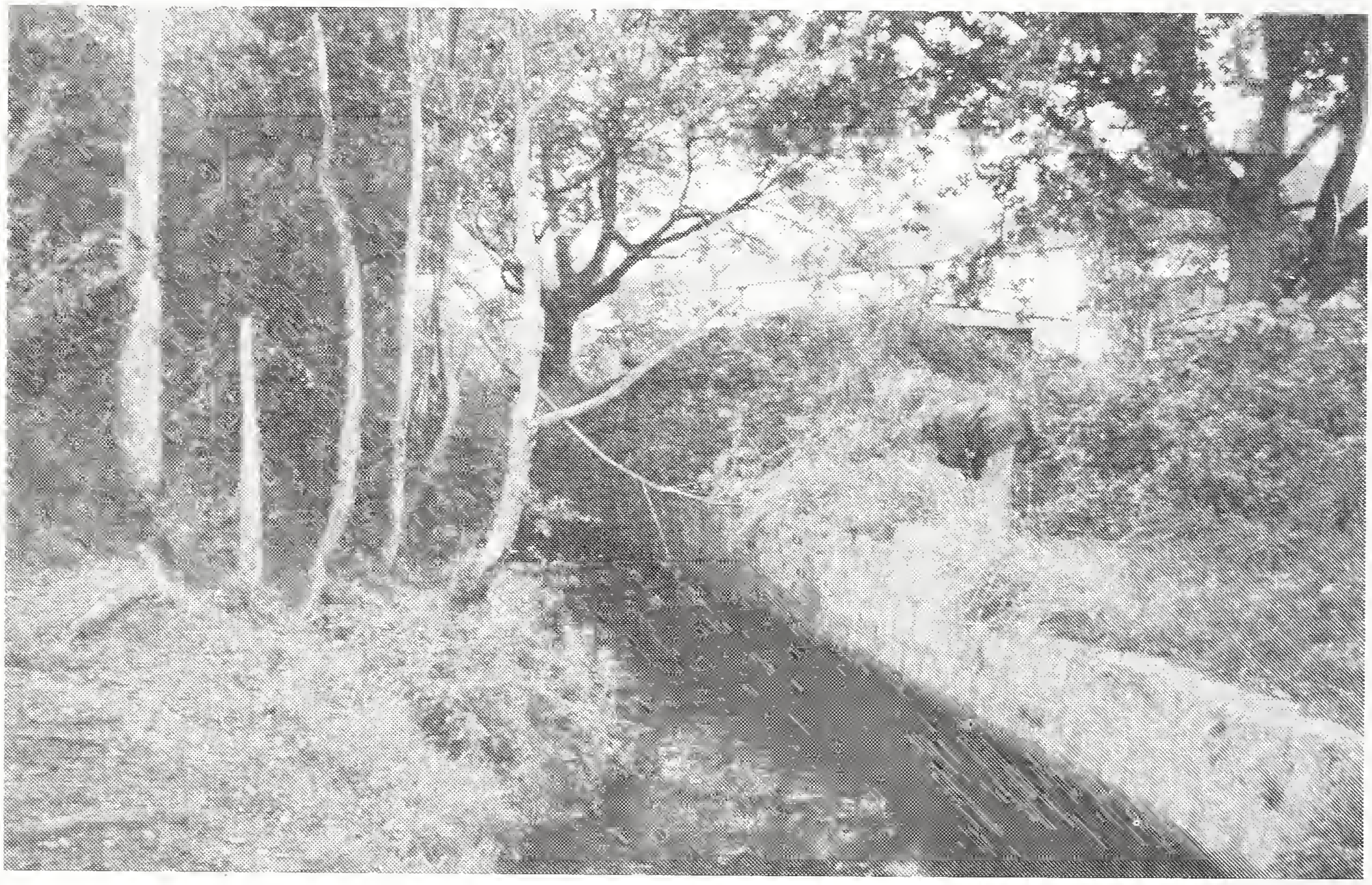

FIGURE 1. The Beverley Brook near the Sir Joseph Hood Playing Fields, a short distance from the sewage treatment works outfall, water from which feeds the Brook. A volunteer, Elizabeth Cheesman, surveys the vegetation where, at this dipping site, the highest-scoring BMWP species found was a water hog louse *Asellus* sp. with a score of three. Further downstream a small unidentified fish was found. *Photo: Freda Turtle*

The London Borough of Havering made a renewed attempt to give itself planning permission to build on the portion of the Inner Thames Marshes SSSI it owns near Rainham. The LNHS vigorously opposed this, as did all the other nature conservation organizations. The Society supported a bid from the Royal Society for the Protection of Birds to the Heritage Lottery Fund to buy the land owned by the Ministry of Defence on the other part of the marshes. This bid was successful and the RSPB have now entered into the complex negotiations necessary to make the purchase and set up a nature reserve (Frontispiece).

There is continuing concern over habitat loss and the decline of biological diversity in the capital. In March, the London Ecology Unit hosted a conference on 'Biodiversity in London Boroughs' at which individual boroughs were encouraged to develop their own Biodiversity Action Plans. In May, the Conservation Officer represented the Society at a further conference on 'Enhancing Biodiversity in Urban Areas' organized by the South-East Region Urban Nature Conservation Forum at which he presented a short paper on 'London's Distinctive Flora'.

The impetus given by various biodiversity initiatives has led to an increased and welcome trend towards cooperative working. It is widely recognized by the various organizations concerned with the biosphere in London that the LNHS has a unique and valuable contribution to make in providing both data and expertise. There are two main obstructions in the way of making this contribution truly effective:

1. Many LNHS members whose contribution is needed cannot attend daytime meetings, as they have to go to work.
2. The information gathered by the Society on the natural history of the London Area is widely scattered. Most of it is not in computer-readable form, and that which is held on computer varies in the extent to which it is compatible with geographically related datasets. For example, the LNHS records OS grid reference and vice-county. The London Ecology Unit (LEU) and the various Biodiversity Partnerships also need records of the borough or modern administrative county, and where possible whether the site is one which has been classified by the LEU as of Metropolitan, Borough or Local Importance (LEU 1985).

In November, Council revised the Society's Records Policy which now contains the following:

> The Society will work towards a central database of biological records for the London Area. For all groups where there is an active recorder, only records which have been approved and/or validated by the recorder will be exchanged or published. In the first instance, the database will be organized by the Nature Conservation Working Group. Each recorder will exercise his/her discretion as to which records he/she makes available to this database.
>
> Information and records should be available without charge for academic study and to bona fide conservation and natural history organizations. When there is a commercial element to any request for information, such information may be made available to organizations and individuals at the discretion of Council or by person/persons appointed by Council for that purpose.

In March Ruth Day attended a conference entitled 'Working Through Local Record Centres' arranged by the National Biodiversity Network (NBN) and held at the Linnean Society. The NBN is organized by a consortium consisting of the Joint Nature Conservation Committee, the National Federation for Biological Recording, the Natural Environment Research Council, The Natural History Museum, the Royal Society for the Protection of Birds and the Wildlife Trusts (RSNC). The conference made it clear that the NBN is here to stay and that eventually national standards of biological recording and data exchange will be established and maintained through a network of local records centres.

Ruth Day also continued to maintain the Society's role as a member of the London Biodiversity Partnership and represented the Society on the Westminster and Lewisham borough partnerships. She is chairman of the Southwark partnership. This meant that she attended eighteen biodiversity meetings during the year. Mike Dennis is active in the Havering partnership, Tony Morris in Bexley, John Barrington in Brent, and David Bevan, the Society's Conservation Officer, is coordinating a biodiversity partnership in Haringey.

Reference

[GREATER] LONDON ECOLOGY UNIT. 1985. *Nature conservation guidelines for London.* Ecology Handbook No.3. Greater London Council.

DAVID BEVAN, *Conservation Officer,*
RUTH DAY, *Secretary, Nature Conservation Working Group*

BOTANY

The Section continues to organize a varied programme of talks and field outings. There were four formal meetings: in February Professor Gren Lucas from the Royal Botanic Gardens, Kew spoke about the use of plants for science, pleasure and economics; in March Dr William Purvis of The Natural History Museum gave a talk on the value of lichens as monitors of environmental health; in June Dr Roger Smith of RBG, Kew talked about the Millennium Seed Bank initiative at Wakehurst Place, and at the AGM in November Colin and Eileen Bowlt gave a joint talk on John Blackstone, the seventeenth-century apothecary and botanist. There were three informal meetings: the usual 'Best Botanical Slides' evening, and two useful identification sessions: one by Geoffrey Kitchener on *Rumex*, and a general one by David Bevan. There was also a meeting organized by Rodney Burton for members to see how records are entered and stored on his computer.

Field trips are far-ranging, sociable and well attended. We had visits to Redhill Common, the North Downs (Box Hill area), Oxleas Wood, Shepperton, sites near Heathrow, Gillespie Park, Fishers Green, Park Downs and Banstead Wood, Whitewebbs Park, Rickmansworth and Croxley Common Moor, Camley Street Nature Park, Fleet Pond, Black Park, Mickleham Downs, the Grand Union Canal in west London, Bishop's Wood, and the popular urban fungus foray in Haringey, a joint meeting with the London Wildlife Trust. Unusually for this section, we also had a weekend visit to an area outside London, Blakeney Point and Holkham in Norfolk, organized by Carol and Bill Hawkins. There have been full and interesting accounts of many of these meetings in the Society's *Newsletter.*

We are pleased to welcome Amanda Waterfield to the Committee; she has agreed to be Lichen Recorder for the Society, and has already been able to help members with identification problems.

Stella Luce and John Topp, who have both served on the Committee for a number of years, have said that they wish to resign. Stella was Indoor Meetings Secretary for about eight years, and John was Field Meetings Secretary for five years. Their hard work and advice have been much appreciated. Ken Adams, who was the Bryophyte Recorder for many years, has also resigned, and is thanked for his contribution to the Section.

RODNEY BURTON, *Chairman,* MARY CLARE SHEAHAN, *Secretary*

ECOLOGY AND ENTOMOLOGY

Once again the Section arranged a variety of indoor meetings of entomological and environmental interest by knowledgeable and interesting speakers. Two meetings were held in March, the first was by John Taylor on beekeeping, illustrated with his apparatus and honey as well as slides; the second was by Gerry Bowdrey on plant galls and gall wasps. Ann Brown spoke to us in June about wildlife conservation in the Falklands. The annual joint meeting with the British Entomological and Natural History Society in September was hosted this year by BENHS when Dr Tom Brereton gave the Brad Ashby Memorial Lecture on aspects of conservation of the pearl-bordered fritillary.

The AGM was given over to a series of reports from eight of the Section's Recorders. Edward Milner (Arachnida) reported that traps on the seventeenth floor of a building in the City had yielded three species of spider, three of beetles and many, many aphids. The habitat of *Atypus affinis,* a spider recently discovered on Hampstead Heath after an absence of a century, had been damaged by mowing. Colin Plant (Lepidoptera) wrote that the project 'Butterflies for the New Millennium' had resulted in many new records, including some for larger moths, and many gaps in the distribution maps are being filled in. He is also working toward a list of microlepidoptera of Middlesex vice-county. Paul Mabbott continues his survey of ground beetles of our area which appear to be under recorded in the light of the recently published provisional atlas of Carabidae in Britain. Clive Herbert, reporting on mammals, said he had received fewer records than in previous years, the majority being of hedgehogs and foxes. He receives few records for rare species such as badgers or common ones such as grey squirrels. **All** records are welcome. The London Mammal Group will be undertaking a resurvey of water voles which are experiencing a significant decline. Ruth Day (Odonata) has been preparing an audit of dragonflies in the thirty-three London boroughs for the London Biodiversity Partnership. There are six species of dragonfly and three of damselfly in every borough except the City. The white-legged damselfly is rare nationally but there are many in the London Area; it is abundant on the River Mole. Her most exciting find this year was the scarce emerald damselfly on Wennington Marsh. Sandi Bain, the newly appointed Orthoptera Recorder, said her most exciting find had been a long-winged cone-head. Ruth Kirk (fish) was gratified by the response of members to her request for information on sticklebacks and minnows. Unlike other fish, these are seldom interfered with by man so show a natural distribution. Twaite shad have made a welcome return to the River Thames as have six salmon. Dan Hackett (Lucanidae and Buprestidae) illustrated the features of the two families of beetle which he records. London seems to be a stronghold for both greater and lesser stag beetle. The Society is fortunate to have such knowledgeable and enthusiastic recorders.

Nine field trips were organized during the year including to Bury Wood in Epping Forest in October, in January to the recently opened London Aquarium, in April to Biggin, Chadwell St Mary, near Tilbury, and in May to Broxbourne Wood SSSI. Three trips were held in July — to Crane Park Nature Reserve for water voles and 'green' frogs, to Black Park SSSI near Slough and to Hampstead Heath for dragonflies. In September we went to an abandoned chalk-pit at Grays looking for plant galls and in October to Molesey Weir to see how salmon are monitored in the Thames.

The sectional committee gave careful consideration to a list of journals proposed for deletion from the Society's library, recommending that some be retained.

Once again the Section represented the Society at the Amateur Entomologists' Society exhibition, enrolling five new members, selling books and journals as well as making the work of the Society known to a wider public.

JOHN A. THOMPSON, *Chairman,* CATHERINE SCHMITT, *Secretary*

ORNITHOLOGY

We are pleased to report that 1998 was again a good year for the Ornithology Section in terms of activities and membership involvement. The field meeting programme was a full one with an outing almost every weekend. Most were to local sites, with such visits helping members to get to know all sorts of interesting but perhaps lesser-known spots and their bird life in and around London. There were also regular coach trips further afield to explore a range of good bird habitats outside London. Destinations included a mix of favourite sites as well as new areas, with a winter trip to Holkham in Norfolk for example producing a fine array of birds on the sea, shore, and a variety of inland habitats. A small group of members also went on a weekend trip to Wales organized by the section, and enjoyed finding some of the specialities of the region. Field trips continued to be well supported, and our thanks go to the members volunteering to lead them as well as to Neil Anderson for organizing a full and innovative programme.

Thanks also to David Montier for organizing the Section's lecture programme. Topics at the nine indoor meetings covered the bird life of a wide range of distant places, but one devoted to the new and exciting Wildlife and Wetlands Trust reserve being developed at Barn Elms close to the centre of our area was of particular relevance. At a rare informal meeting some interesting specimens in the Society's skin collection were on display.

The *London Bird Report* for 1997 was again a credit to all those involved, under the editorship of Andrew Moon. The complexities involved in its production, however — not least the heavy burden of time on the volunteers — were the subject of discussions on how best to ensure the Report's continued timely appearance and high quality. The 1997 issue had articles on two birds new to the London Area — pied-billed grebe and great white egret. A review of the ongoing Breeding Bird Survey for 1997 also noted two new species for that list (whimbrel and lesser spotted woodpecker), in the total of 90 logged in the 47 squares surveyed. It was again disappointing that the long-awaited *Atlas of breeding birds in the London Area* had not been completed by the end of the year, and discussions continued on the best way to move this forward. The two-monthly *Ornithological Bulletin* continued to provide a range of interesting bird records from in and around London, thanks to records submitted by a large number of observers and the editorship of David Montier.

Thanks are due to all the officers and committee members who contributed to the Section's smooth running in 1998.

RON KETTLE, *Chairman*, NICOLA DUCKWORTH, *General Secretary*

RAMBLERS, ARCHAEOLOGY AND GEOLOGY

The Section has continued to provide a very varied programme of indoor meetings and field trips. Due to the increasing age of some members, walks have been shorter in some cases than usual. Eight indoor and fifteen field meetings were held. The indoor meetings covered archaeology, geology and ornithology and had an average attendance of nineteen. The most popular was a talk in January by Angela Wardle who spoke about the cemeteries of Roman London and had twenty-three members attending. The talk in April given by John Thompson on the Channel Islands — Mounds, Megaliths, Castles and Conquests — also had an archaeological flavour. The February meeting given by Dennis Clarke on the work at Duck Island and St James's Park was also popular. The May meeting was entitled 'Vesuvius — the Sleeping Giant'. This was given by Richard Wilding who showed pictures of the volcano and discussed its history and associated geology. This attracted seventeen members. Fifteen members arrived for the talk on Insects in Amber on 10 June at the London School of Economics. The speaker, Andrew Ross of The Natural History Museum, was unable to deliver his talk because no projector was provided in spite of its being ordered. The meeting was curtailed as only a few printed pictures could be shown. On 29 June Julius Bryant of English Heritage came to give a talk on Down House and other collections. This talk attracted twenty-two members and was an appropriate one because a week or so before some twenty-six members had visited the house in Kent. The Section's AGM was held on 19 October and the Chairman delivered a talk entitled 'Some Natural and Historical Highlights of East Anglia'. Jane Siddell of The Museum of London completed the indoor programme on 4 November with a talk on environmental archaeology.

The first field meeting of the year was to the new Earth Galleries at The Natural History Museum and was followed in February with a visit to Covent Garden to see the market area, the church, the opera site excavations and hidden courtyards. Two field meetings were held in March, the first to Lesnes Abbey for daffodils and wood anemones and the second to Old Redding, Harrow and Grimsdyke. Thirteen members attended a Building Stone walk from the Royal Exchange to St Giles, Cripplegate on 4 April. Two field trips were organized for May. The first was to Horsenden Hill with a canal-side walk to Perivale Woods in bluebell time. The second was to the Rye House RSPB reserve. On 6 June a full-scale geological excursion was run to Herne Bay and Reculver. This attracted ten members. Lower Eocene strata were observed and a search was made for the celebrated Corbula Bed. On 19 July Helen Hartley led a Three Mills tour. This included a tour of House Mill which is a restored tidal mill. This was followed in August with a visit to Wimbledon led by Ruth Day in a search for dragonflies. Later in September Bert Wright took a party of members to Eynsford to see the church and the castle followed by a visit to Lullingstone Roman Villa. On 3 October there was a visit to Bletchley Park. It was here that many people worked in secret during the Second World War to break the enemy code. There was a guided tour to see the cryptology exhibits. The field visit in November was a joint one with BNA to Crystal Palace and the programme ended on 12 December with an ornithological visit to St James's Park followed by a visit to nearby Westminster Abbey to see the Chapter House, Pyx Chamber and Museum.

Thanks are due to all those speakers, leaders and members who have made this very varied programme possible.

RICHARD E. BUTLER, *Chairman,* DOREEN E. WOODS, *Secretary*

Book review

Lepidoptera of St Agnes, Isles of Scilly. Michael E. Hicks and John W. Hale. [1999]. 74pp., numerous tables of data. A5, folded and stapled. Published by the authors. No ISBN. Available from the authors at Langarth, St Agnes, Isles of Scilly TR22 0PL at £7.50 plus 50p UK postage.

Subtitled *A systematic list and analysis of the species recorded on St Agnes 1992 – 1997,* this publication provides the reader with a well-presented, highly accurate account of all the species of moths, both micro and macro, and butterflies, recorded on St Agnes during the years stated. The book was written to provide readily available answers to the plethora of requests for information which the authors regularly receive from visiting naturalists (mainly birders) and in this task it has excelled. Each species is ranked from Rare, through Scarce, Uncommon and Common, to Abundant, on the basis of the number of records available and it is very pleasing indeed to see that the authors have also included a table showing trapping frequency in each month of the six years covered so that each status can be put into proper perspective.

For almost all species, a table shows the date of the first and last record in each of the six years as well as 'Maximum number & date' which equates to what is more usually referred to as the 'peak period'. A few words of free-text are also provided for each species.

Sitting at my desk in the relatively species-rich South-East I was fascinated to see just which species can be found on this small island, to which I have not yet travelled, and to learn something of their status there. The book makes no pretension at being definitive — it presents existing knowledge accurately and concisely in a booklet that can be easily tucked into a rucksack or collecting bag. It should prove indispensable to anyone who visits St Agnes to study or collect and falls very easily into my 'highly recommended' category.

COLIN W. PLANT

Book reviews

Insects on dock plants. David T. Salt and John B. Whittaker, with illustrations by Michael J. Roberts. Naturalists' Handbooks 26. Richmond Publishing Co., Slough. 1998. 56 pp. £15 hardback, ISBN 0 85546 310 4; £8.95 paperback, ISBN 0 85546 309 0.

Studying those insects associated with a single hostplant narrows down the spectrum of species to a manageable number. The fauna (and some of their parasitoids) feeding on docks and sorrels, *Rumex* spp., is the subject of this latest Naturalists' Handbook. A student or field naturalist can, by using this book, it suggests, become familiar enough with insect identification to make a contribution to ecology fairly quickly. How well does this book succeed in providing adequate keys and ideas to be pursued? Its fifty-six pages present several ecological themes illustrated by the insect fauna on docks as well as ideas to pursue. The identification key section is generally well laid out with helpful line diagrams accessible nearby at the page sides. The four artwork colour plates are reasonably accurate, but I would comment that *Apion frumentarium*'s legs are not actually quite so thick as drawn and that *Rhinoncus pericarpius* (both Plate 1) has a markedly contrasting tuft of yellowish scales along the elytral suture just behind the scutellum, but this is not as clear in the drawing as in life. *Gastrophsa viridula* (Plate 2) is a brilliant metallic green leaf beetle, but this unfortunately does not come across well in the illustration. Identification should be easy enough if specimens are taken and worked through the keys, once one has overcome initial problems of correlating characteristics used in the key with what one is looking at. How comprehensive can a small book like this be? Species wise, it includes the larva of the large copper butterfly *Lycaena dispar*, restricted to one British site (Woodwalton Fen) but omits the large brown squash bug *Coreus marginatus* (which is very common on dock and some other Polygonaceae all over London at least) — perhaps it is deemed too polyphagous, but then the garden tiger moth *Arctia caja* is included. The short answer is that additional insects will occur, requiring reference to supplementary literature. As the book advises, voucher specimens of smaller insects had better be retained and compared to reference specimens to sort out the small black and bluish *Apion* weevils, for example.

Nevertheless, noting presence or absence of even a few of the distinctive species (and this is a matter of experience) within season, whilst on one's travels across such an area as London might reveal that several of these have curious distributions; this is the most likely use an LNHS member will put this book to. Although docks are common plants, some of the insects feeding on them are probably not. Experience shows some nationally common species also turn out to be common in London, others are in fact rare (and vice versa). Distribution studies can lead to a local status assessment.

Whether a particular species is being affected by the urban environment fragmenting its habitat, for example, would make an interesting study. Some insects spread easily and cope with small or temporary habitat patches better than others. The need for ecologists to inform management to get conservation of local biodiversity right is now greater than ever. This book would be the ideal starting point for such a study.

D. S. Hackett

Insects on cherry trees. Simon R. Leather and Keith P. Bland, with illustrations by Miranda Gray. Naturalists' Handbooks No. 27. Richmond Publishing Co., Slough. 1999. 82pp. £15 hardback, ISBN 0 85546 312 0; £8.95 paperback, ISBN 0 85546 311 2.

This book is a worthy addition to the series, it has been well thought out and the wealth of detail included is admirable.

The section on identification is particularly helpful, to both professional and amateur, but the book is liable to confuse the beginner in its complexity. Determination and a keen interest in nature should help, but as usual in nature studies, it also helps to have a friendly guide to steer you onwards!

No fault has been found, but the reviewer would have liked to see 'Plant galls' as an item in the index, as several references occur in the text, and it would ease the search if they had been included.

The descriptions of cherry species are welcome, giving details of origin, growth, distribution, flowering and fruiting. The table of insects feeding on cherry trees is interesting. The second chapter, 'Island biogeography and species area studies', would be particularly useful for a student worker searching for an ecological theme, an area which is often found difficult because of the mathematics involved.

The chapter 'Techniques' is good, and covers all relevant aspects for collection, study and compilation of reports. The appendices for Useful Addresses, Insect Checklist, and Further Reading, are very helpful. Suggestions for further studies occur throughout the text — select you own!

Ken Hill

Ecological characteristics of the flora of urban derelict sites in London

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Abstract

Urban derelict land has been much maligned for aesthetic and socio-economic reasons, and is directly threatened by 'brownfield' development. These sites demonstrate, however, the ability of nature to persist under the modified conditions of urbanization and transform derelict sites from 'eyesores' to places that are valuable both for wildlife and the human population. The naturally colonizing species of urban derelict land are distinct, and often unique, communities that are the 'nature' of towns and cities. They are botanically diverse, ecologically intriguing, and reflect the history and culture of urban areas, yet they have been neglected by ecologists and conservationists. This paper considers the value of urban derelict sites and describes some results of botanical surveys of sixteen sites in the east London area.

Introduction

This paper is based on part of the research carried out for a doctoral thesis (Chipchase 1999), concerned with the social and ecological value of urban derelict sites. These values are generally ignored by planners and developers in their drive to clear sites and impose often 'sterile' landscapes, that take no account of the species that have naturally colonized urban areas. These species form distinctive communities that are as ecologically 'valid' as our semi-natural habitats and, thus, offer great scope for study.

In the UK derelict land is defined as 'land which has been so damaged by industrial and other development that it is incapable of beneficial use without treatment' (DoE 1991). Underlying this definition is the assumption that land should be used constructively, and its focus is land that has been actively damaged by human activity. The definition has been much criticized over the years (e.g., Civic Trust 1964, Barr 1969, Fairbrother 1972, Wallwork 1974), particularly for excluding land that others consider should also be defined as derelict. The definition has served, however, simply to identify land qualifying for Derelict Land Grant for remediation.

Derelict land has been described as 'blight', 'wasteland', 'eyesores', 'damaged', 'despoiled' and 'uncivilized', all terms that compound a strongly negative perception. A perception that has been compounded by the majority of ecologists and conservationists who have neglected urban derelict sites. This neglect now conspires with the drive to develop urban 'brownfield' sites.

Brownfield is a recent term that lacks an official definition, and refers to land that has previously been developed. It is a term intended to convey the dogma that the development of such sites is a good thing. Following projections of the need for 4.4 million new homes by 2016 (DoE 1995), and great consternation about 'creeping urbanization' in the countryside, the government has proposed that 60 per cent of new housing be located on 'brownfield' land. Some agencies, e.g., the Council for the Protection of Rural England, are calling for this figure to be 75 per cent (Oliver, pers. comm.).

The Urban Task Force (UTF), was set up by the government in May 1998 to 'establish a new vision for urban regeneration' (UTF 1999). Unfortunately the Task Force and developers have singularly failed to recognize that urban derelict land, i.e., brownfield land, is capable of its own regeneration.

Derelict land is land released from management and left to natural processes, i.e., colonization and succession (GLC 1985, RSNC n.d.). Derelict sites provide opportunities for the establishment of a variety of species in urban areas. Gilbert (1989) uses the term 'urban commons' to describe these urban sites that have developed spontaneously, are characterized by disturbance and support distinctive communities of anthropogenic and synanthropic species. Over time, the cover of vegetation can transform these sites from 'eyesores' to attractive open space. Urban derelict sites provide urban areas with their own natural 'wilderness' and have been recognized as important constituents of urban open space for people, making a significant contribution to the quality of urban life (Kaplan 1984, Barker 1989, Harrison 1993, Huang et al. 1992, Rohde and Kendle 1994). In some parts of London they are the only greenspace around (Frith, pers. comm.). Derelict sites also provide valuable habitats for wildlife, the presence of which increases human contact with nature (Mabey 1980) and offer opportunities for ecological research and educational studies across the syllabus (Tregay 1983, Shepherd 1995).

These positive views have been voiced not only by those concerned with nature conservation (e.g., Teagle 1978, Goode 1986, Gilbert 1989, Morphet 1990), but also by planners (GLC 1986, LPAC 1995, GFA/Tibbalds Monro 1996, Land Use Consultants 1996).

Urban derelict land now attracts the interest of a wide audience, i.e., ecologists, nature conservationists, planners, developers and the general public. These parties, however, all hold divergent views and expectations, which pose both problems and challenges to the future of these natural urban habitats.

The National Land Use Database (NLUD) has been set up to compile land use data for England in a GIS (Geographical Information System)-based system. This will inform English Partnerships and planners as to land available for development. NLUD has asked local authorities to provide statistics for the following:

1. Previously developed land that is now vacant.
2. Vacant buildings.
3. Derelict land and buildings.
4. Other previously developed land and buildings allocated for development or with planning permission for housing.
5. Other previously developed land or buildings with known potential for redevelopment (Anon 1998).

Of concern is the failure to consider any qualitative assessment of these sites. The fear is that sites that have developed a nature conservation value, but are not formally recognized as such, will be lost to development. The way in which local authorities interpret this request remains to be seen.

Many derelict sites are now recognized as being of local and national nature conservation value e.g., Nobb End (Shaw and Halton 1998), and Gunnersbury Triangle. A significant proportion of these sites are now designated as SSSIs (Sites of Special Scientific Interest), the highest 'accolade' for UK conservation sites. CORDATA lists for SSSIs in England, Scotland and Wales show that a minimum of 4 per cent (102) of all biological SSSIs are on 'damaged land'. If geological SSSIs are included then 10 per cent (32) of all mixed SSSIs (earth science and biological value) are on damaged land (DoE 1996). In London over 250 Sites of Nature Conservation Interest are either wholly or partially brownfield (Frith, pers. comm.).

The following quotes are testimony to the ecological value of derelict sites:

> 'Many former mineral extraction and manufacturing sites now constitute important habitats for uncommon species of the British flora' (Davis 1976).
>
> 'The urban derelict habitats of towns and cities, and the vegetation communities they support, are good hunting grounds for botanists. (Urban areas have) high floral diversity (and urban derelict land) can make a significant contribution to the nature conservation resource of urban areas' (Shepherd 1995).
>
> 'Cities are . . . dynamic biogeographic environments where conditions may change rapidly and where unusual combinations of plants, animals and insects may develop' (Douglas 1983).
>
> 'Botany need not be restricted to the countryside' (Hadden 1978).

Not everyone is of the same mind, however: 'cities are environmental disaster zones' (Nicholson-Lord 1994).

Until relatively recent times, with a few exceptions, ecologists and naturalists have tended to ignore urban habitats, their being perceived as 'artificial', i.e., 'unnatural' (Freethy 1986, Cairns 1987, Botkin 1990, Rees 1997). Such sentiments appear to have their origin in an anthropocentric desire to draw a clear line separating humans from the rest of the natural world, and it has important repercussions for urban habitats.

'Naturalness' underlies much conservation theory, management and prioritization, e.g., the selection of SSSIs. This, according to Barker (1991), can be attributed to the 'conceptual difficulties' experienced by ecologists who have 'generally learnt their trade amongst rural habitats'. The dismissal of a major biotic influence, i.e., humans, implies that humans are 'unnatural', further compounding negative attitudes towards urban habitats. Such thinking consigns a significant part of ecological theory to a historical study, and has important repercussions for urban habitats.

Ecological 'disdain' for urban habitats is also aggravated by an apparent xenophobia regarding the presence of 'alien' species. The introduction of 'aliens' has been effected deliberately and accidentally by human activity that, in the eyes of many ecologists and conservationists is, and has been, sufficient to 'discredit' the individual species and the communities of which they are a part. This is not to deny that certain introductions, i.e., those that are invasive, are proving to be problems, but many species are 'well-integrated' (Barker 1996).

Fortunately, there exists a different perspective:

> 'Change can increase the richness of our flora by creating new environments suitable for native species previously of very limited distribution, and for new species introduced from abroad . . . the future flora of Britain could be larger than the flora of the past' (Perring 1974).
>
> '(The large number of naturalized aliens in Britain is) tremendously exciting. Our flora has gone through a revolution as great as the colonization of these islands after the ice age. The change has been very sudden; the majority of these naturalized species have been introduced in the past 200 or 300 years' (Ingrouille 1995).

Several assumptions are made about derelict land and the characteristics of its colonizing species. First, urban derelict land is generally regarded as a single habitat type. Second, urban derelict land is considered a 'hostile' environment (Haigh 1980). Species occurring on derelict land must, therefore, possess the requisite adaptations, e.g., tolerance of stressful conditions. Third, they are temporary communities, characterized by wind-dispersed species (e.g., Dowdeswell 1987). The results of the current research show that these are simplistic and uninformed assumptions.

The key biotic and abiotic factors that influence world biomes are the same ones that operate in urban areas. These factors, are, however, modified by the urban environment, and the communities of urban derelict land have developed under these modified factors. The absence of direct management etc., on derelict sites means that their ecosystems are more natural than those of gardens etc., and, as such, they offer valuable ecological insights into the interaction of urbanization with natural cycles (McDonnell et al. 1997).

The following summarizes the influence of four important environmental factors operating in urban areas that have a marked effect on plant species and, therefore, influence the types of species colonizing urban sites.

Substrate

Urban substrates are variable in their characteristics. They do, however, possess several characteristics in common, i.e., compaction, extremes of pH, low nutrient levels, lack of organic matter, and the presence of pollutants (these are described in detail by Gilbert (1989)).

Perhaps the major difference between urban and non-urban soils is that of the lithologic discontinuities (Gilbert 1989), i.e., the lack of a relationship between the urban substrate and the natural underlying geology and topography. Such discontinuities are evident on urban derelict sites where, over a relatively small area, there are sudden changes in the vertical and horizontal zonation of the substrate (Harris 1995, Effland and Pouyat 1997).

The substrate of many urban derelict sites cannot be described as a soil. Concrete surfaces, walls and areas of brick rubble, for example, are the urban equivalent of cliffs and scree slopes. The skeletal nature of the substrate has important repercussions for plant life. The initial lack of organic material and microbial activity, for example, results in a poor crumb structure (Bradshaw and Chadwick 1980). Poor structure affects the ability of the soil to retain water and limits its nutrient content. Nitrogen, potassium, phosphorous and other nutrients essential for plant growth are, consequently, in short supply (Bradshaw and Chadwick 1980). Low fertility, however, restricts the invasion and dominance of nutrient-demanding species, and provides opportunities for a wider diversity of less 'aggressive' colonizers (Land Use Consultants 1996). Despite the limitations, the 'artificial' nature of urban areas provides conditions that can be successfully exploited by a wide range of species (Fitter 1945, Gill and Bennett 1973, Gilbert 1989).

Climate

A distinguishing feature of urban areas is the urban 'heat island', a 'dome-shaped mass of warmer air with sharply defined boundaries' (Burton 1983) with a climate distinct from that of the surrounding areas. The heat island has significant impacts on the ecology and biology of urban plant species (Table 1). The urban heat island is a complex phenomenon. The combination of high temperatures and low humidity contributes to the water stress experienced by the species of urban derelict land, where skeletal soils have little or no water retention capability.

TABLE 1. The effects of the urban heat island.

1. Increased air pollution: emissions from vehicles and industry are trapped during heat inversions.
2. Reduction of solar radiation.
3. Raised ambient air temperatures within the city.
4. Reduction in air humidity of 5–10%.
5. Mean reduction in wind speed of 10–20%.
6. Increased precipitation of 5–10% and reduced snowfall.

Compiled from Horbert (1978), Gilbert (1989), Stopa-Boryzka et al. (1994), Zimny (1994).

Precipitation is increased in urban areas (Horbert 1978), however, the additional rainfall is not generally available to the vegetation, and does not alleviate the arid conditions that tend to typify urban derelict sites. The rapid run-off from impervious surfaces, e.g., concrete and tarmac, for example, is quickly channelled into storm drainage facilities. Run-off rates from impermeable surfaces in urban areas can be as much as 90 per cent, compared to 10–15 per cent where there are no roads and buildings (Barker and Graf 1989). The fast run-off also reduces the rate of groundwater recharge. Additional problems of water availability result from high levels of water abstraction and the lowering of groundwater levels in connection with construction work.

The heat island of cities provides opportunities for the colonization of species unable to tolerate conditions outside the city. Some plants and animals can, therefore, extend their range into colder, more northern, areas (Barker 1989). Many aliens generally require higher temperatures than do native species (Sukopp et al. 1979, Pysek and Pysek 1991), and this is one reason why urban areas typically support a higher proportion of alien species. London experiences more very hot days than the rest of the country, bringing its urban climate closer to a Mediterranean type. This permits species such as perennial wall-rocket *Diplotaxis tenuifolia* and Oxford ragwort *Senecio squalidus* to flourish (Burton 1983).

Pollution

Pollution has long been a problem affecting urban areas. Generally speaking, the main sources of urban pollutants are vehicle exhausts, gaseous and particulate emissions from manufacturing and chemical industries, agriculture, food processing, waste discharges, run-off, etc. (Hardman et al. 1993). Some pollutants are released at high concentrations from point sources e.g., metal smelters and chemical processing, whilst others are released at low concentrations from numerous diffuse sources, e.g., vehicle exhausts, leachate from domestic disposal sites, etc. Important urban industrial pollutants include carbon monoxide, carbon dioxide, nitrous oxides, sulphur dioxide, artificial organic compounds and heavy metals. The last includes copper, nickel, cobalt, zinc, lead, cadmium and iron.

The type of impact a pollutant can have on plant species and their environment is illustrated by the effects of sulphur dioxide (SO_2). SO_2 is produced by the combustion of coal and oil and, when combined with moisture in the atmosphere, forms sulphuric acid (H_2SO_4), a constituent of acid rain that has significant effects on soil and vegetation (Sketch and Bareham 1994, Bisset and Farmer 1994).

Dry deposition of SO_2 is converted to sulphuric acid by moisture on the leaves of plants, which attacks and corrodes leaf tissue, i.e., necrosis (Haigh 1980, Ehrlich 1988). SO_2 can also be converted to acid in the soil (Ehrlich 1988), thereby lowering the soil pH (Gilbert 1989). Acidification not only increases the leaching of essential plant nutrients, such as calcium and magnesium, it increases the solubility of toxic metals, such as aluminium, iron and manganese, whilst rendering other valuable elements, such as potassium, insoluble, (O'Hare 1989).

Sulphur dioxide, therefore, exerts a direct physiological and/or indirect physical impact on species. Increased levels of sulphur dioxide in Britain's urban areas have had a noticeable effect on lichen and bryophyte species (Seaward 1979, Gilbert 1989). The mapping of lichen zones in Greater London in 1967 showed a strong correlation with levels of sulphur dioxide (Bowen 1974). Extremely acid conditions are not, however, devoid of vegetation and have proven to be of particular floristic interest. Scottish bings (waste tips), for example, support a number of species that are rare elsewhere, e.g., common wintergreen *Pyrola minor,* the hawkweed *Hieracium gougetianum,* and Young's helleborine *Epipactis youngiana* (Allan et al. 1997).

Disturbance

Disturbance is generally cited as the main characteristic of urban ecosystems where there is 'continual exposure to drastic and rapid change caused by demolition of buildings and the redevelopment of sites in quick succession' (Freethy 1986). Disturbance, however, is an equally unpredictable feature of natural ecosystems (Sprugel 1991). Disturbance in urban areas takes different forms from that of its 'natural' counterpart, e.g., bulldozing, tipping, trampling, vehicular movement, and horticultural operations (Gilbert 1989), the effects are similar in both and equally complex. 'Repeated disturbances which preclude the occurrence of mature or climax vegetation can lead to a progressive depletion of species. . . . In contrast disturbance regimes are often important for the maintenance of diversity and should be an integral part of management programmes' (Peet et al. 1983).

Disturbance in urban areas has direct and indirect impacts on soils and vegetation. Despite being a well-studied phenomenon in semi-natural habitats, there is little information available about the effects of disturbance on the urban landscape and vegetation (Foresman et al. 1997). This is one demonstration of the failure to treat urban landscapes as ecological units (Sprugel 1991).

Although the precise details of a disturbance event may be unknown, the effects of, and responses to, disturbance by plant species appear to be the same in both urban and rural areas. Whilst perceived as a destructive activity, disturbance creates heterogeneity at the landscape level, and sites for colonization at the community level (Zipperer et al. 1997). Disturbance, therefore, makes a positive contribution to the variety of species and habitats present in urban areas.

The removal or reduction of the existing vegetation by disturbance provides opportunities for the successful colonization of those species less able to compete in established vegetation. In urban areas disturbance has assisted the colonization of large numbers of alien species (Henke and Sukopp 1986, Gilbert 1989). In the open conditions of urban habitats, especially derelict sites, native species have exhibited greater ecological amplitude compared to the closed vegetation of their natural habitats (Zipperer et al. 1997).

Urban derelict sites provide interesting and exciting areas of study. Yet planning decisions are being made about the future of these sites with no acknowledgement of their ecological and social value. The current wave of 'regeneration' projects and proposals for the development of brownfield sites threaten an important resource. Decisions should be made in the light of ecological knowledge. It is essential, therefore, that extensive ecological study be devoted to urban derelict sites in order to inform planning decisions, lest valuable sites are lost. This research is an initial step in addressing their neglect.

Methods and sites

Sixteen derelict land sites were surveyed across east and south-east London. The sites surveyed represent a range of derelict sites typical of the region. These included a former petrol station forecourt, fireworks manufacturing site, Ministry of Defence firing range, a water authority pumping station, sites of sand and gravel extraction that had subsequently been landfilled, and a sports ground. The majority of these sites were located in urban London, a few were on the urban fringe. The factors affecting them all are similar. A summary of some site features is provided in Table 2.

The current survey methodology followed a European phytosociological approach in the identification and mapping of homogenous stands of vegetation. A stand is defined as 'a unit of vegetation that is essentially homogenous in all layers and differs from contiguous vegetation types by either quantitative or qualitative characteristics' (Daubenmire 1968).

Table 2. Selected features of the derelict sites surveyed.

Previous site use	Size of area surveyed	Age	Substrate	No. of stands	No. of species	Disturbance
Garage	<0.5 ha	<5 yrs	Concrete, skeletal	7	54	Dumping
Fireworks factory	7.9 ha	7–10 yrs	Soil, concrete	22	118	Minimal
Water pumping station	1.25 ha	40+ yrs	Soil, rubble	5	78	Trampling – minimal
Various	0.5 ha	30 yrs	Rubble, soil	22	119	Trampling/dogs
Sports ground	0.5 ha	20 yrs	Soil, rubble, concrete	14	117	Trampling/dogs/motorbikes
Timber yard	4 ha	50 yrs	Rubble	15	155	Trampling/dumping
Public toilets	<0.1 ha	>5yrs	Concrete, skeletal	3	39	Minimal
Gravel works/landfill	22.8 ha	30 yrs	Rubble, topsoil, soil	9	105	Trampling/fires/grazing
Gravel works/landfill	20.3 ha	50 yrs	Topsoil, rubble	8	72	Trampling/dumping/fires
Grazing marsh	5 ha	Unknown	Unknown	11	52	Dumping/fires/vehicles
Railway embankment	<1 ha	40 yrs	Rubble, ballast	13	85	Trampling
MoD firing range	16 ha	5–10 yrs	Soil, sand	26	82	Minimal
Cottage garden, car park	<0.3 ha	20 yrs	Soil, rubbish	7	33	Dumping
Landfill	1 ha	40 yrs	Skeletal	3	35	Bikes/fires
Landfill	1.5 ha	50 yrs	Topsoil	30	54	Dumping/trampling/vehicles
Open space	1 ha	30 yrs	Unknown	15	62	Dumping/fires

Stand location was mapped and notes made of the environmental conditions on the site. Full species lists and the cover of all flowering plant species were compiled for each stand. Cover was estimated using the DAFOR scale (Dominant, Abundant, Frequent, Occasional, Rare). Species known to have been planted were noted. Two hundred and ten stands were mapped and surveyed on the sixteen sites, and a total of 336 species recorded. Species that did not occur in recognizable stands were not recorded. Total species numbers for some sites were, therefore, higher than the numbers given in the results.

Notes were made about the area surrounding each site, e.g., land use, presence of roads, industry, housing, green space, etc., and their use, both formal and informal. Location and use have direct and indirect impacts on a site. These affect not only the biological properties of a site, but the way in which a site is perceived. Perception is an important factor affecting derelict sites, and this is discussed more fully in the thesis (Chipchase 1999).

Table 2 shows that there is no clear relationship between the number of stands and/or species on a site, with site size or age. The complexity of the conditions present on derelict sites provides a heterogenous environment that defies simple explanation. Small derelict sites may contain a high number of stands and species, and large sites may be dominated by a few homogenous stands.

The following results form part of the analysis undertaken on the survey data; for the full analysis, Chipchase (1999). The data collected have been analysed on the basis of species autecology and species communities, i.e., the 210 stands. The analysis was separated into three broad areas:

1. Analysis of the ecological characteristics of the species recorded on derelict land sites and their comparison with species from a broader range of habitat types. The autecological analysis aimed to identify those characteristics common to species colonizing urban derelict sites, which may distinguish them from other habitat types.

2. Analysis of the individual stand communities of derelict land in order to determine their relationship with the abiotic conditions.

3. Analysis of the environmental conditions of the derelict land sites to identify links between the type of site and the characteristics of species/communities.

The autecological analysis was based on the concept of plant functional types, or plant strategies (Grime 1974, 1979). Functional types are considered to have resulted from '. . . some avenues of adaptive specialization (which are of) universal occurrence' (Grime 1996). This suggests that specific environmental conditions will tend to lead to a specific set of adaptive specializations. The environmental conditions associated with derelict land should, therefore, be reflected in the presence or dominance of certain functional types on these sites.

The CSR model of primary plant strategies (Grime 1979) proposes that vegetation developing in a particular place at a particular time is the result of an 'equilibrium established between intensities of stress, disturbance and competition' (Grime et al. 1988). They recognize, however, that in the real world this equilibrium has its own dynamic varying from place to place, within communities and over different time-scales, whilst the permutations of high/low stress with high/low disturbance result in strategies which are described as 'recurrent types of specialization associated with particular habitat conditions or niches'.

Grime's (1979) primary strategies are as follows:

1. C strategists (competitors) prevail under the threat of competitive exclusion. Competitors are characterized by their ability to maximize resource capture in productive, relatively undisturbed conditions, i.e., they exploit conditions of low stress and disturbance, and are fast-growing and large.

2. S strategists (stress-tolerators) demonstrate endurance in continually unproductive environments through reduced vegetative and reproductive vigour, i.e., they tolerate high stress and low disturbance, are slow-growing and small.
3. R strategists (ruderals) exploit severely disturbed, potentially productive habitats, i.e., low stress and high disturbance, are fast-growing and small.
4. CSR strategists (generalists) exploit the 'middle ground' and do not possess adaptations specific to a particular suite of environmental conditions.

Grime (1974) considers that there is no strategy that can cope with both high stress and high disturbance. For further details of CSR strategies and plant autecology, see Grime (1979) and Grime et al. (1988).

Analysis of the characteristics of plant species found on the derelict sites surveyed was undertaken using the FIBS database (Functional Interpretation of Botanical Surveys) as developed by J. G. Hodgson, and supplemented with additional data (Hodgson, pers. comm.). The data presented in FIBS are derived from the autecological data of Grime et al. (1988) for 502 species of higher plant covering twenty-four species characteristics.

The data for the species from the derelict sites were compared with that compiled by Grime et al. (1988) for species from a wider range of habitats as an initial step in identifying any distinguishing features.

Results

The analysis for the research focused on the seven species characteristics listed in Table 3. These characteristics were those for which the greatest information was available. The results of five characteristics are summarized in this paper, i.e., family, life cycle, established strategy, life form and dispersal.

TABLE 3. Species characteristics analysed.

1. Family
2. Life cycle
3. Established strategy
4. Regenerative strategy
5. Life form
6. Dispersal mechanism
7. Abundance in seven primary habitat types

Family — A total of 336 species was recorded, comprising fifty-eight families. As a percentage of the UK flora, this represents 7 per cent of the total number of species and 35 per cent of UK families (Stace 1997). With regards London's flora, this represents 16 per cent of the species and 34 per cent of the families listed by Burton (1983). Table 4 presents, in descending order, those families with more than five species recorded on derelict land, with the results of other urban surveys. The number of representative species in each family is fairly consistent across the surveys. It appears that the families common to urban derelict land are the families common to the urban environment generally. Significantly, the top ten families are common to all the surveys.

Life cycle — A common assumption regarding derelict land and the species it supports is that both are short-lived (e.g., Gill and Bennett 1973, Dowdeswell 1987). The results of the analysis of life cycles of urban derelict land species in Table 5 suggests otherwise. The data of the current survey revealed that between

62 per cent and 65 per cent of the species recorded were perennials. This indicates firstly, that the species colonizing derelict sites have a longer lifespan than generally stated and, secondly, that derelict sites are more stable and less ephemeral than assumed.

TABLE 4. Well-represented families in surveys of urban flora.

East London		**London**		**Sheffield**		**Belfast**	
Chipchase (1999)		Jones (1957)		Whiteley (1988)		Beesley and Wilde (1997)	
Family	No. of spp. recorded	Family	No. of spp. recorded	Family	No. of spp. recorded	Family	No. of spp. recorded
Compositae	50	*Com*	55	*Com*	52	*Com*	56
Gramineae	40	*Gra*	33	*Gra*	37	*Gra*	52
Leguminosae	25	*Cru*	30	*Cru*	34	*Cru*	43
Cruciferae	24	*Leg*	22	*Leg*	28	*Ros*	33
Rosaceae	21	*Ros*	15	*Ros*	21	*Leg*	32
Umbelliferae	13	*Car*	14	*Scro*	17	*Scro*	29
Polygonaceae	12	*Scro*	10	*Lab*	16	*Car*	20
Carophyllaceae	12	*Umb*	8	*Car*	14	*Lab*	19
Scrophulariaceae	12	*Pol*	8	*Pol*	10	*Pol*	18
Labiatae	8	*Lab*	7	*Umb*	9	*Umb*	16

TABLE 5. Comparison of the life cycles of species recorded on urban derelict sites with those of species recorded from a broad range of habitats (Grime et al. 1988).

Life history	**Current survey**		**Grime et al. (1988)**	
	Species recorded	Percentage species	Species recorded	Percentage species
Annual	58	17	94	19
Annual or biennial	12	3	2	<1
Annual or perennial	9	2	17	3
Biennial or perennial	3	1	5	1
Perennial	210	62	384	76

Annual species form an important component of the vegetation of both surveys (17–23 per cent of species on derelict land, compared to 19–24 per cent in other habitats). Annuals, according to Kent and Coker (1992), are more likely to dominate disturbed/ephemeral areas within a site, where conditions are open and there is little or no competition. It would, therefore, be expected that there would be a higher proportion of annuals present on the derelict sites surveyed than on other habitat types. This was not the case. The result indicates that derelict sites are either longer-lived, and/or less disturbed, than is generally assumed, or that other habitats are more, or equally, disturbed.

Established Strategy — Species from the full range of Grime's (1979) strategies, i.e., three primary and four intermediate strategies, were recorded on derelict land sites. Excluding the CSR generalists, the competitive element exceeds that of the other primary strategies, i.e., stress-tolerators and ruderals. There were 97 (68 per cent) species with a competitive element, compared to 48 (34 per cent) with a stress-tolerant element and 42 (30 per cent) with a ruderal element. This is contrary to assumptions about the 'hostile' environment of derelict sites, i.e., that these conditions favour ruderal and stress-tolerant species.

On derelict sites, variation in conditions provides opportunities for both competitors and stress tolerators. A similar percentage of ruderal species was recorded in the present survey of derelict land and the surveys of Grime et al. (1988), i.e., 16 and 18 per cent respectively. This similarity may indicate that disturbance is as much a feature of derelict land as other habitats.

Generalists compose the highest proportion of species in both surveys (34 and 36 per cent), indicating that a generalist strategy is successful across a wide range of habitats.

Life form — All of the life form types described by Grime et al. (1988) are represented in the species recorded on derelict land. The presence of a range of life forms indicates the wide range of environmental conditions in these areas. The datasets are generally comparable in terms of the percentages of each life form present. Hemicryptophytes are twice as common as any other life form in both surveys (44 and 46.8 per cent of all species, respectively). This is not, however, surprising as hemicryptophytes are the largest and most diverse class in the British flora (Turrill 1948).

The presence of phanerophytes in both surveys (13 and 7 per cent respectively) and chamaephytes (4 and 7 per cent of all species), can be an indicator of the successional stage reached by a site. Both, however, can be important colonizers on certain types of substrate (Shepherd 1995), such as railway ballast, and are not reliable indicators under these conditions.

Dispersal — Knowledge about dispersal mechanisms is inadequate (Grime et al. 1988), therefore, the results presented in Table 6 can only be used as a general indication of dispersal mechanisms. Table 6 presents the results of the five main means of dispersal as recognized by Grime et al. (1988).

TABLE 6. Comparison of modes of dispersal used by species of urban derelict sites with those of a broad range of habitats (Grime et al. 1988).

Mode of dispersal	**Current survey**	**Grime et al. (1988)**
	Percentage of species	Percentage of species
Unspecialized*	32	31
Animals	30	32
Wind	28	28
Water	8	10
Vegetative fragments	<1	<1
Unknown	0	1

*Unspecialized, i.e., morphological features facilitating dispersal are absent or undetected.

There is a close correlation between the two datasets with regards percentage of dispersal methods and order of importance. Wind, although generally considered to be an important dispersal agent for species on derelict land (Fitter 1945, Jones 1957), ranks third behind unspecialized and animals in both surveys.

Wind-dispersed species may well be the first colonizers of derelict sites, as they were on the bomb sites following World War II (Jones 1957), but they are soon joined by species employing other mechanisms.

The large proportion of species using animals as a primary means of dispersal (30 per cent in both datasets) may appear surprising, particularly in the case of urban derelict sites. There are, however, a number of factors to consider. First, little is known about the ecology and movement of animals, especially small mammals, in urban areas. Certain small mammals, e.g., bank vole, field vole and harvest mouse, are not present in inner urban areas, whilst species such as the brown rat may have a role in dispersal (Frith, pers. comm.). Second, birds have an important role in dispersal, and many bird species are increasing in towns and cities. Third, humans are a numerous animal in urban areas, as are their cars. Trouser turnups (Salisbury 1964) and the mud on car tyres (Darlington 1969) and motorcycles are but two examples of likely dispersal modes.

Given the inadequacy of information about dispersal mechanisms, the constancy of dispersal methods shared by the two sets of data indicates that a diversity of dispersal methods is important across a wide range of habitats, and that derelict land is not typified by any one method. The results also indicate that derelict sites are not as ecologically, or physically, isolated as is generally presumed, and suggests their potential importance as refugia, or centres of dispersal for species.

Discussion and conclusion

The autecological analysis of species recorded on urban derelict land was undertaken to establish which characteristics the urban environment selects for in the plant species naturally colonizing these sites. The analysis employs the concept of plant functional types, which is based on the theory that specific environmental conditions tend to lead to a specific set of adaptive specializations (Grime 1996). The importance of the life history characteristics of individual species in determining the pattern of succession, has long been noted (e.g., Gleason 1926).

The environmental conditions of urban areas have produced urban plant communities that are distinct from those of rural areas. Yet, there are strong similarities in their autecological characteristics, particularly life histories, CSR strategies and dispersal mechanisms. Traditional views of species of derelict land have typified them as wind-dispersed ruderals, a description that is not borne out by the results of the analysis. Wind-blown ruderals may typify the early stages of dereliction, when an area is opened up, but they are not representative of the majority of derelict sites surveyed. The results show that no one plant strategy is clearly dominant on derelict sites. All the primary and intermediate strategies identified by Grime et al. (1988) have a role in the plant communities of derelict land, thus demonstrating the heterogenous nature of the derelict land environment.

Gilbert's (1989) study of succession on 'urban commons' charts the changing nature of vegetation and species over time. On many derelict sites early successional stages are determined by the initial substrate(s), and successional progression is affected by the different forms of disturbance to which a site may be subjected. These stages cannot be generalized. The number of different stands recorded on the sites surveyed illustrates both the range in conditions across each site and/or the differential effects of disturbance. There are some interesting features about the species recorded. Contrary to general assumptions, stress tolerators form a lower percentage of species on derelict land than those recorded in a broad range of habitats (Grime et al. 1988). This may be due to the lowland situation of the derelict sites surveyed, but may also indicate that stress is not necessarily a widespread condition across derelict sites. Generalists comprise the higher proportion of primary strategy in both data sets, suggesting the success of this flexible strategy in a wide range of habitats. Competitors emerged as a more significant component of derelict sites compared to the broad range of habitats (29 and 19 per cent respectively). Derelict sites are, therefore, more productive environments than commonly assumed.

Disturbance is an extremely complex factor. The type and level of disturbance occurring on a site has a significant impact on succession and is a key factor in determining the diversity of urban sites. Disturbance can create gaps within productive environments providing patches for colonization that are temporarily free of competition. The intermediate disturbance hypothesis (Connell 1978) proposes that a moderate level of disturbance will provide the greatest diversity in a way that is analogous to the higher diversity of mid-successional stages (Bazzaz 1998). Similarly, diversity can be high on derelict land sites that vary in size and levels of disturbance.

The species and communities present on derelict sites have developed in response to conditions created by an urbanized environment, i.e., conditions influenced more profoundly by human activity than any other. As such, they provide enormous scope for study, particularly of primary succession and species adaptation. The relationship between natural and human forces cannot be ignored if concern about urban environmental conditions and the health of urban dwellers is to be more than political rhetoric, i.e., 'sustainable development'.

The current research has shown that urban derelict land can contain a variety of habitat types, colonized by species with a wide range of characteristics and survival strategies. Even small tracts of land can support a number of communities, a function of varying substrate and disturbance levels. Urban derelict sites are far from simple habitats. Their complexity is derived from an amalgam of natural processes and the activities of the dominant species, humans. These habitats are a current manifestation of evolutionary processes and, as such, are the natural habitats of cities. The great variation within and between sites provides exciting opportunities for study. The research has shown that urban derelict land consists of a range of habitat types, colonized by species with a wide range of characteristics and survival strategies. Small tracts of land can support a number of communities, a function of varying substrate and disturbance levels.

Negativity about urban areas and their natural habitats has resulted in their neglect by ecologists, and the fact that little is known about the ecology of urban areas is easily used to justify their development. This is demonstrated in the work of the UTF which has to date failed to recognize the value of naturally colonized urban sites and the contribution they make to the quality of urban life. The value of urban derelict sites, for both wildlife and the urban population, has been gaining recognition (e.g., Gilbert 1989, Shepherd 1995, Frith 1999). Their past neglect, however, conspires with the rush to develop, 'regenerate' and 'green' urban areas, in effect, facilitating their destruction. 'Brownfield' development, currently being touted as the 'salvation' of the countryside, is not necessarily beneficial for the urban population or its wildlife. Resources need to be dedicated to surveys and research of urban derelict land, in order that their value can be better appreciated and to inform the development process.

These sites are on our doorsteps; there is no excuse for their being so understudied. Fitter (1945) admonished ecologists who lived in urban areas for their 'shameful neglect . . . [of the] . . . flora of the waste sites that lie under their noses', a rebuke which still needs to be heeded. The loss of these sites will be a great loss to the urban environment. For many, they are what makes living in towns and cities bearable.

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References

ALLAN, R.L., DICKINSON, G., DICKINSON, J.H., DUNCAN, H.J., MURPHY, K.J., PULFORD, I.D., ROGERSON, R, and WATSON, K. 1997. The natural heritage interest of bings (waste tips) in Scotland: inventory and review. *Scottish Natural Heritage Review,* No. 48. SNH, Edinburgh.

ANON. 1998. *Vacant and derelict sites and other previously developed land and buildings that may be available for redevelopment.* Data Specification, National Land Use Database, Phase 1.

BARKER, G. 1989. *People and wildlife in cities.* Women's Coruna Society, 9th Triennial Conference, Westminster, 13 July 1989. Published informally in notes of conference.

BARKER, G. 1991. Streets of gold. *Environmental Interpretation.* February: 7–8.

BARKER, G. 1996. Alien and native — drawing the line. *Ecos* **17**(2): 18–26.

BARKER, G. and GRAF, A. 1989. Principles for nature conservation in town and cities. *Urban Wildlife Now* **3**. NCC, Peterborough.

BARR, J. 1969. *Derelict Britain.* Penguin Books, Harmondsworth.

BAZZAZ, F.A. 1998. *Plants in changing environments. Linking physiological, population and community ecology.* Cambridge University Press, Cambridge.

BEESLEY, S. and WILDE, J. 1997. *Urban flora of Belfast.* The Institute of Irish Studies, The Queen's University of Belfast.

BISSET, K. and FARMER, A. 1994. *SSSIs in England at risk from acid rain.* English Nature, Peterborough.

BOTKIN, D.B. 1990. *Discordant harmonies.* Oxford University Press, New York.

BOWEN, H.J.M. 1974. Air pollution and its effect on plants. *In* Perring, F. (ed.), *Flora of a changing Britain.* BSBI, London.

BRADSHAW, A.D. and CHADWICK, M.J. 1980. *The restoration of land.* Blackwell Scientific Publications, Oxford.

BURTON, R.M. 1983. *Flora of the London Area.* London Natural History Society.

CAIRNS, J. 1987. Disturbed ecosystems as opportunities for research in restoration ecology. *In* Jordan, W.R. III, Gilpin, M.E. and Aber, J.D. (eds), *Restoration ecology: a synthetic approach to ecological research.* Cambridge University Press, Cambridge.

CHIPCHASE, A. 1999. *The ecological and social value of urban derelict land and some characteristics of its natural communities.* Unpublished Ph.D. thesis. University of Greenwich.

CIVIC TRUST. 1964. *Derelict land.* Civic Trust.

CONNELL, J.H. 1978. Diversity in tropical rain forests and coral reefs. *Science* **199**: 1302–1310.

DARLINGTON, A. 1969. *Ecology of refuse tips.* Heineman, London.

DAVIS, B.N.K. 1976. Wildlife, urbanisation and industry. *Biol. Conserv.* **10**: 249–291.

DAUBENMIRE, R. 1968. *Plant communities. A textbook of plant synecology.* Harper and Row, New York.

DoE. 1991. *Survey of derelict land in England 1988.* **1.** HMSO, London.

DoE, 1995. *Projections of households in England to 2016.* HMSO, London.

DoE. 1996. *Reclamation of damaged land for nature conservation.* HMSO, London.

DOUGLAS, I. 1983. *The urban environment.* Edward Arnold, London.

DOWDESWELL, W.H. 1987. *Ecology. Principles and practice.* Heinneman Educational Books, London.

EFFLAND, W.R. and POUYAT, R.V. 1997. The genesis, classification and mapping of soils in urban areas. *Urban Ecosystems* **1**: 217–228.

EHRLICH, P.R. 1988. *The machinery of nature.* Paladin Graften Books, London.

FAIRBROTHER, N. 1972. *New lives, new landscapes.* Penguin Books, Harmondsworth.

FITTER, R.S.R. 1945. *London's natural history.* Collins, London.

FORESMAN, T.W., PICKETT, S.T.A. and ZIPPERER, W.C. 1997. Methods for spatial and temporal land use and land cover assessment for urban ecosystems and application on the greater Baltimore-Chesapeake region. *Urban Ecosystems* **1**: 201–216.

FREETHY, R. 1986. *Guide to wildlife in towns.* British Naturalists' Association. The Crowood Press, Marlborough.

FRITH, M. 1999. Brownfield sites must be valued as urban open space. *Urban Environment Today,* 4 March.

GFA CONSULTING in association with TIBBALDS MONRO. 1996. *Greening the city: a guide to good practice.* HMSO, London.

GILBERT, O. 1989. *The ecology of urban habitats.* Chapman and Hall, London.

GILL, D. and BENNETT, P. 1973. *Nature in the urban landscape. A study of city ecosystems.* York Press, Baltimore.

GLEASON, H.A. 1926. The individualistic concept of the plant association. *Bull. Torrey bot. Club.* **44**: 463–481.

GOODE, D. 1986. *Wild in London.* Michael Joseph Ltd, London.

GREATER LONDON COUNCIL.1985. *A nature conservation strategy for London: woodland, wasteland, the tidal Thames and two London boroughs.* Ecology Handbook No. 4. GLC.

GREATER LONDON COUNCIL. 1986. *Open space planning in London.* Habitat Handbook No. 2. GLC.

GRIME, J.P. 1974. Vegetation classification by reference to strategies. *Nature, Lond.* **250**: 26–31.

GRIME, J.P. 1979. *Plant strategies and vegetation processes.* John Wiley and Sons, Chichester.

GRIME, J.P. 1996. Report of the Unit of Comparative Plant Ecology 1994–96. NERC.

GRIME, J.P., HODGSON, J.G. and HUNT, R. 1988. *Comparative plant ecology.* Cambridge University Press, Cambridge.

HADDEN, R.M. 1978. Wild flowers of London W1. *Lond. Nat.* **57**: 26–33.

HAIGH, M.J. 1980. Ruderal communities in English cities. *Urban Ecology* **4**: 329–338.

HARDMAN, D.J., McELDOWNEY, S. and WAITE, S. 1993. *Pollution ecology and biotreatment.* Longman Scientific and Technical, Harlow.

HARRIS, J. 1995. Soils, the basic substrate for conservation in the urban landscape. *Land Contamination and Reclamation* **3**(2): 82–83.

HARRISON, C. 1993. Nature conservation, science and popular values. *In* Goldsmith, F.B. and Warren, A. (eds), *Conservation in progress.* John Wiley and Sons, Chichester.

HENKE, H. and SUKOPP, H. 1986. A natural approach in cities. *In* Bradshaw, A.D., Goode, D.A. and Thorpe, E. (eds), *Ecology and design in landscape.* 24th Symposium of the British Ecological Society. Blackwell Scientific Publications, Oxford.

HORBERT, M. 1978. Klimatische und Lufthygienische Aspekte der Stadt- und Landschafts planung. *Natur und heimat* **38**: 34–49.

HUANG, J., RITSCHARD, R., SAMPSON, N. and TAHA, H. 1992. The benefits of urban trees. *In* Abbari, H., Davis, S., Dorsano, S., Huang, J. and Winnett, S. (eds), *Cooling our cities: guidebook on tree planting and light-coloured surfacing.* US EPA Office of Policy Analysis, US Superintendent of Documents, Washington D.C.

INGROUILLE, M. 1995. *Historical ecology of the British flora.* Chapman and Hall, London.

JONES, A.W. 1957. The flora of the City of London bombed sites. *Lond. Nat.* **37**: 189–210.

KAPLAN, R. 1984. Impact of urban nature: A theoretical analysis. *Urban Ecology* **8**: 189–197.

KENT, M. and COKER, P. 1992. *Vegetation description and analysis.* Belhaven Press, London.

LAND USE CONSULTANTS in association with WARDELL ARMSTRONG. 1996. *Reclamation of damaged land for nature conservation.* Report for DoE. HMSO, London.

LONDON PLANNING ADVISORY COMMITTEE. 1995. *State of the environment report.* LPAC, London.

MABEY, R. 1980. *The common ground: a place for nature in Britain's future.* Hutchinson, London.

McDONNELL, M.J., PICKETT, S.T.A., GROFFMAN, P., BOHLEN, P., POUYAT, R.V., ZIPPERER, W.C., PARMELEE, R.W., CARREIRO, M.M. and MEDLEY, K. 1997. Ecosystem processes along an urban-to-rural gradient. *Urban Ecosystems* **1**: 21–36.

MORPHET, J. 1990. Can we save urban open space? *Ecos* **11**(4): 27–33.

NICHOLSON-LORD, D. 1994. *Calling in the countryside: ecology, parks and urban life.* Working Paper 4. Comedia Demos, Gloucester and London.

O'HARE, G. 1989. *Soils, vegetation and ecosystems. Conceptual frameworks in geography.* Oliver and Boyd, Essex.

PEET, R.K., GLENN-LEWIN, D.C. and WALKER-WOLF, J. 1983. Prediction of man's impact on plant species diversity. A challenge for vegetation science. *In* Holzner, I., Werger, M.J.A. and Ikusima, I. (eds), *Man's impact on vegetation.* Junk, Netherlands.

PERRING, F.H. 1974. Preface. *In* Perring, F.H. (ed.) *The flora of a changing Britain.* BSBI, London.

PYSEK, P. and PYSEK, A. 1991. Succession in urban habitats: an analysis of phytosociological data. *Preslia* **63**: 125–138.

REES, W.E. 1997. Urban ecosystems: the human dimension. *Urban Ecosystems* **1**(1): 63–75.

ROHDE, C.L.E. and KENDLE, A.D. 1994. *Human well-being, natural landscapes and wildlife in urban areas. A review.* English Nature Science, No. 22. English Nature, Peterborough.

RSNC. n.d. *Derelict land.* The Royal Society for Nature Conservation.

SALISBURY, E. 1964. *Weeds and aliens.* Collins, London.

SEAWARD, M.R.D. 1979. Lower plants and the urban landscape. *Urban Ecology* **4**: 217–225.

SHAW, P. and HALTON, W. 1998. Classic sites: Nob End, Bolton. *British Wildlife* **10**(1): 13–17.
SHEPHERD, P.A. 1995. A review of urban floras and plant communities: Implications for nature conservation. *Land Contamination and Reclamation* 3(2): 67–69.
SKETCH, C. and BAREHAM, S. 1994. *Terrestrial SSSIs at risk from soil acidification in Wales.* Countryside Council for Wales, Bangor.
SPRUGEL, D.G. 1991. Disturbance, equilibrium and environmental variability: what is 'natural' vegetation in a changing environment? *Biol. Conserv.* **58**: 1–18.
STACE, C. 1997. *New flora of the British Isles.* (Ed. 2). Cambridge University Press, Cambridge.
STOPA-BORYCZKA, M., KOPACZ-LEMBOWICZ, M. and BORYCZKA, J. 1994. Positive and negative effects of the urban heat island in Warsaw. *Memorab. zool.* **49**: 69–80.
SUKOPP, H., BLUME, E.P. and KUNICK, W. 1979. The soil, flora and vegetation of Berlin's wasteland. *In* Laurie, I.C. (ed.), *Nature in cities.* John Wiley and Sons, Chichester.
TEAGLE, W.G. 1978. *The endless village.* Nature Conservancy Council, Peterborough.
TREGAY, R. 1986. Design and ecology in the management of nature-like plantations. *In* Bradshaw, A.D., Goode, D.A. and Thorpe, E. (eds), *Ecology and design in landscape.* 24th Symposium of the British Ecological Society. Blackwell Scientific Publications, Oxford.
TURRILL, W.B. 1948. *British plant life: a survey of British natural history.* Collins, London.
URBAN TASK FORCE. 1999. *Urban renaissance. Sharing the vision.* P.28. DETR, Wetherby.
WALLWORK, K.L. 1974. *Derelict land.* David and Charles, Vermont.
WHITELEY, D. (ed.). 1988. Sheffield's urban wildlife. *Sorby Rec.* **25**: 1–104.
ZIMNY, H. 1994. Ecological foundations for the management of the natural environment in urbanised conditions. *Memorab. zool.* **49**: 35–48.
ZIPPERER, W.C., SISINNI, S., POUYAT, R. and FORESMAN, T.W. 1997. Urban tree cover: an ecological perspective. *Urban Ecosystems* **1**: 229–246.

Book review

Grasshoppers and crickets of Surrey. David W. Baldock. Surrey Wildlife Trust. 1999. 111 pp., 16 colour plates. Hardback, £12 plus £2 p. & p. from Marketing Department, Surrey Wildlife Trust, School Lane, Pirbright, Woking, Surrey GU24 0JN, payable to Surrey Wildlife Trust. ISBN 0 9526065 4 2.

Grasshoppers and crickets of Surrey is an attractive guide to this small group of insects, which also includes the native cockroaches and earwigs. Whilst it does not attempt to replace the need for an identification key or field guide, it is a valuable complement. The detailed, descriptive field notes for each species would help a novice recorder to confirm identity. The sections on the history of recording in Surrey, and the recent use of bat detectors make interesting reading. I enjoyed reading the 'squashed on the road' method of recording the oak bush-crickets, which are easily identified by their blue-green blood. Indeed, throughout the book the text is informative, easy to read and bears witness to David Baldock's extensive knowledge of the subject. The strength of the book lies in the detailed observations of each species, their behaviour, variation and times of activity.

As the county of Surrey contains the majority of Britain's Orthoptera, the book is a very comprehensive account, of value to recorders everywhere and certainly throughout the London area. I found the colour photos particularly useful, since they are taken in the field showing the insects in natural habitats, exhibiting behaviours such as courtship, mating and ovipositing. Photos of nymphs are very helpful — and the picture of a speckled bush-cricket in the beak of a whitethroat illustrates the value of these relatively common insects in a healthy ecosystem.

The notes on distribution and current status are very up to date, replacing the information in older field guides. However, with the increased sophistication of computer mapping I found the dot maps rather old fashioned and crude. I would like to have seen a larger, more detailed map of the area showing distribution of species overlaying factors other than geology, e.g., habitat, urban development, etc. Also, the gazetteer in the appendix would have been more useful if it cross-referenced the species found in each location. It is a laborious task to read through the text for each species to establish records for a particular site.

Despite this, the book is a valuable addition to the series, of interest to expert and novice entomologist alike.

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A survey of vascular plants in the Wildlife Garden of The Natural History Museum

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Summary

A survey of vascular plants was carried out in the Wildlife Garden of The Natural History Museum, South Kensington. The results, discussed in relation to the plant communities the garden has set out to present, show that the garden is host to a wide diversity of plants. Accommodating invading species, more vigorous community members and unspecified cultivars are just some of the challenges encountered in a wildlife garden created in central London. This paper complements the findings of a survey of cryptogamic plants and fauna published recently in *The London Naturalist* (Honey et al. 1998).

Introduction

Background

The Wildlife Garden was created to provide an educational resource to promote an understanding of the balance and relationships between plants and animals, both for children and adult visitors to the Museum. The background, design and wider aims of The Natural History Museum Wildlife Garden have already been fully described (Honey et al. 1998).

The management aim of the Wildlife Garden is not only to promote species diversity but also to create and manage different communities of plants, representing those found in a range of habitats in lowland Britain. Regular monitoring will highlight the different plant strategies within and between these habitats, thus providing information on the viability of habitat creation on a small scale in the inner city. The habitats these communities are designed to represent have developed over thousands of years and we are fully aware that we are unable to re-create the precise conditions in a small area in central London. Monitoring over a period may offer information on species unable to survive in the inner city, species that will tolerate inner-city conditions, and species that thrive there. Arguably, such a garden should have been created using local genetic stock only but this was not practical. The garden would have taken several more years to complete using only seed collected from London's woods, meadows and heathland.

Vascular plants create structural and species diversity both to attract, feed and harbour wildlife and also in many instances to provide a means of transporting additional species of animals, including insects, into the Wildlife Garden. For example, 'The sudden appearance in September 1995 of several molluscan species . . . is probably related to the introduction of submerged and marginal macrophytes into the pond during the summer of 1995' (Honey et al. 1998: 29). It is therefore essential in the overall monitoring scheme, not only to monitor the development of the vegetation as first planted in 1995 but also to record subsequent deliberate introductions and the sources of these plants. In addition, monitoring should provide the data to enable comparisons to be made between the different methods of habitat creation including habitat translocation, seeding, and planting of individual plugs or pot plants.

Monitoring of the Wildlife Garden's flora and fauna was started soon after the initial planting in 1995 and detailed observations of cryptogamic plants and animals including insects presented. Monitoring of the vascular plants was also started in 1995 and preliminary observations described (Honey et al. 1998: 24).

The purpose of this report is to complement that data with the results from a survey of vascular plants and to comment on the development of plant communities in the Wildlife Garden. The main objective of the survey was to establish baseline data from which future monitoring and management might be assessed.

The nomenclature follows Stace (1997).

Aims of the survey report

1. To present the results of the baseline survey.
2. To compare species identified and recorded in 1998 with those known to have been planted in 1994/5 and subsequent introductions.
3. To assess and compare the characteristics of each habitat with the characteristics of the lowland habitat it is designed to represent.

Management update (since the previous report)

A new management plan was written in January 1998 highlighting areas/habitats to be developed. As recorded in the previous report (Honey et al. 1998: 20) most of the remaining vestiges of ornamental plantings were removed from the south and west perimeters of the garden in November 1997. This exposed areas to the street but it is hoped that the barrier of mainly hawthorn, together with blackthorn, dog rose and elder will soon provide an effective barrier screening traffic and at the same time providing additional cover for wildlife.

Additional plants have been introduced to supplement the ground flora in the woodland areas, hedgebanks, grassland, heathland, fen and ponds.

In April 1998 the heathland habitat was developed and extended with material kindly donated by Dorset County Council and translocated by Alaska Environmental Contracting. At the time of writing a small area of wet heathland was being created with the help of a financial donation from the Metropolitan Public Gardens Association. Wet heathland turfs have been donated by Dorset County Council and lifted by their Conservation field team with the help of some of our team of regular volunteers (Figure 1).

The woodland area (S18, P1) was reseeded in April 1998 with Emorsgate Woodland wild flower mix with grasses. Although it is generally accepted that autumn sowing produces better results than spring sowing, autumn sowing is not practical in most areas of the garden due to the almost immediate disturbance created by raking off the plane tree leaves from October to December.

Plants collected from Wicken Fen and donated by The National Trust in April 1998 enhanced a small area of the fen (W4). It is hoped further to improve this habitat, south of the boardwalk, by the insertion of a Rawmatt clay liner to increase water retention in the area. This will then be planted with turf collected from Hickling Nature Reserve and donated by the Norfolk Wildlife Trust. A ditch has also been dug out, to which plants will be added, further to diversify our fen habitat. This is to be completed late spring 1999.

FIGURE 1. Lifting turfs from Slop Bog for replanting in the Wildife Garden.
Photo: Sue Snell

A new hedge was planted along the north boundary of the meadow (S35) and a small corner, liberated from the ornamental shrub area, was added to the meadow sown with Emorsgate Cricklade mix. The meadow (approximately 220 sq. m.) was managed until September 1997 as an amenity lawn area with surrounding margins of meadow plants dominated by oxeye daisy *Leucanthemum vulgare,* yarrow *Achillea millefolium,* betony *Stachys officinalis* and meadow geranium *Geranium pratense.* The closely mown lawn area was reduced when mowing recommenced in April 1998 and further reduced in July 1998; it is now restricted to a mown path for access through the taller grasses.

Irrigation of the entire site has been a problem and lack of irrigation may account for some plant failures in the early years. A comprehensive, timed irrigation system has now been installed by Waterworks Irrigation UK who kindly donated part of the cost of equipment and installation. The system will enable us to focus on different areas at specified intervals and periods.

Pond management

The main pond was colonized by blanket weed *Cladophora glomerata* which was raked off at intervals, but not during the summer months due to the amount of wildlife that would have been removed with the weed. Barley straw was used in an experiment in 1996 but failed to stem the growth of *Cladophora* (Martin 1999). The reasons for this failure are not clearly understood. The growth of blanket weed, however, is thought to have accelerated as a result of topping up the pond from the mains water supply. An outbreak of water fern *Azolla filiculoides* in February 1998 was successfully halted before it became a problem.

Methods

The survey

Monitoring takes place informally by regular observation. Since January 1998 first and unusual flowerings have been noted as they appear.

Plant recording took place more formally between May and October 1998 in the main habitat areas except the woodland area along the south-west boundary (S18, P1) which was seeded in April 1998. An area of grassland (S26, W2–3) was excluded due to continuing works associated with the borehole as was the site set aside for the new wet heathland (S9) (Figure 2).

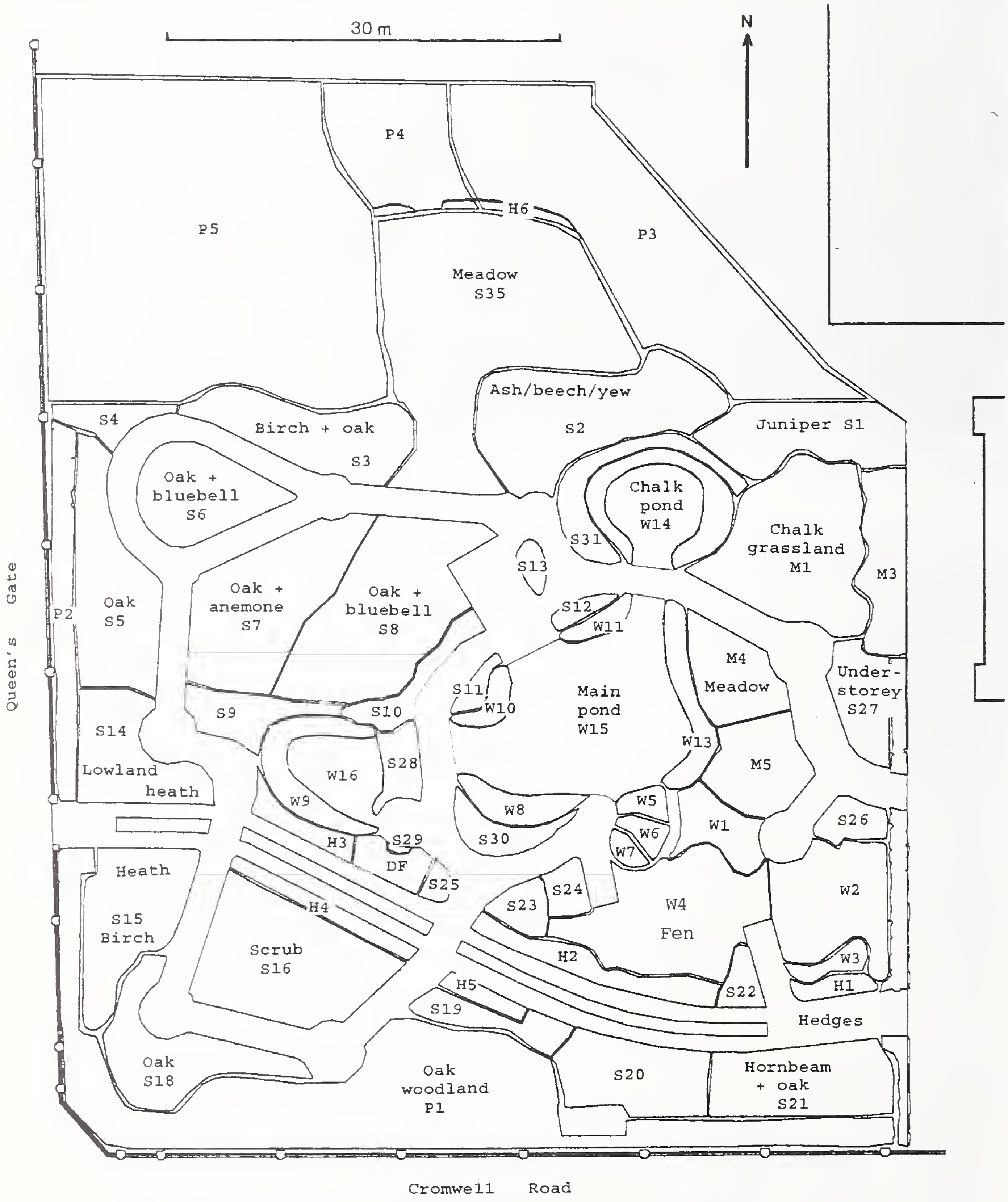

FIGURE 2. Diagram showing the layout of the Wildlife Garden with habitat areas and their codes.

Species were identified and abundance recorded in each plot following the method set up in 1995: 1–10, 11–50, 51–100 and >100. All records were entered on the database previously described (Honey et al. 1998: 22). The survey data were converted and presented using Excel 97 and a BASIC program.

Additional data were collected from the meadow (S35). At the time of the meadow survey (August 1998) there were distinct areas of tall (>8 cm) and short sward. Ten quadrat samples (0.5 × 0.5 m) were randomly placed in the tall sward and ten in the area of short sward. Quantitative presence values were entered for all vascular species using the Domin scale of cover; average sward height and percentage cover of bare earth were also recorded. Soil analysis was carried out to determine pH of the soil at different locations in the meadow. The data were analysed using the Twinspan classification program. Twinspan classifies the sample quadrats based on the relative similarity of their species composition (see Kent and Coker (1992) for further details). The data were then compared to the National Vegetation Classification (NVC) grassland communities using the TABLEFIT Version 0.0 program.

Planting records

Data were extracted from the 1994/5 planting records, where available, and entered in the database.

Plants which have been introduced since 1995 have been recorded on the database as follows: species, number and origin of plants, date planted and location.

Several habitats within the garden were regularly monitored during the period 1995–1997; this provided valuable information on species present during those years and will be referred to in the discussion below.

Photography is a particularly useful means of recording the visual development of the landscape and flowering plant communities; a photographic record of the garden's development has been kept since early constructional work in 1993.

The species recorded in the survey were compared with the list of original plantings in the context of habitat communities, noting species which were initially introduced as seeds, plugs or pot plants, species which have come into the garden unaided and remnants of the former, ornamental garden. Due to the different methods of arrival of species it was not possible to compare species abundance in 1995 with abundance in 1998.

A additional tree survey to record sizes of all species was carried out in December 1998.

Results

The total number of vascular plant species identified in the survey area was 324. This included those planted as plugs during 1998 and early 1999 but does not include species added as seeds during that period. The survey results are summarized in Table 1. A list of all vascular plant species, arranged alphabetically by family, and the habitat in which they were found, is contained in Appendix 1. It is not the intention in this report to list all species and species abundance within each plot, though the data will be referred to in the discussion. The complete data are, however, available on request from The Natural History Museum.

There were approximately 110 species of plant known to have been introduced in the initial plantings in 1994/5. This does not include unspecified invaders. Management records indicate that certain species such as groundsel *Senecio vulgaris*, redshank *Persicaria maculosa* and bindweed *Convolvulus arvensis* were a problem early on and had to be removed. However, for the purposes of the report it will be assumed that most of the invaders arrived between the opening and the 1998 survey.

Species which were planted or sown in 1995 but which were not present in 1998 are noted in the discussion below.

TABLE 1. Number of species by habitat type (code numbers included).

Habitat	Code	Number of species
Woodland	S3–8, S10, S15/P1, P1/S18, S19/21, S20	142
Scrub	S1, 16–17	68
Hedgerow	H1–6	86
Grassland	M1/2, M4–5, S35	121
Heathland	S14, 15	25
Wetland (ponds and banks, fen and reedbeds)	W14, 15, 16, W8–11, 13, W12/S31 W1, 4–7, S11, 28, 30	137
Urban	M3	29
Other	DF, P3, 5, S9, S23–25, 27	59
Total number of species, all areas (not sum)		324

Meadow survey

The total number of species recorded in the meadow was 50, 31 of which were recorded in the 20 quadrats.

Twinspan analysis revealed, at the second division, three endgroups relating to the areas distinguished by three main cutting times:

A: former lawn area where close-mowing ceased in autumn 1997.

B: former lawn area where close-mowing ceased in July 1998.

C: taller margins surrounding former mown lawn.

The fourth endgroup related to two samples only, one in tall sward and the other on the edge of the mown path. The positions of the quadrats in the meadow are shown in relation to these endgroups in Figure 3.

The TABLEFIT program was used to compare each of the three main endgroups to the NVC communities (Rodwell 1992). Whilst the neutral grassland sub-community MG7a *Lolium perenne–Trifolium repens* was ascribed to the short sward where close-mowing ceased in July 1998, the goodness of fit was poor, at 54 per cent. Goodness of fit was very poor for the other endgroups. Nevertheless, at the time of the survey, the three main stands in our meadow show a greater similarity to NVC community MG7 *Lolium perenne* leys and related grasslands, than to any other NVC grassland community. The soil pH ranged from 6.9 to 7.4.

Discussion

The findings of the survey are discussed in the context of the developing community/habitat they are designed to create. Issues encountered during the development and management of the garden and which are common to all plant communities are discussed separately rather than repeating the issue under each habitat heading. The habitat code numbers, in brackets, relate to those on the plan — Figure 2.

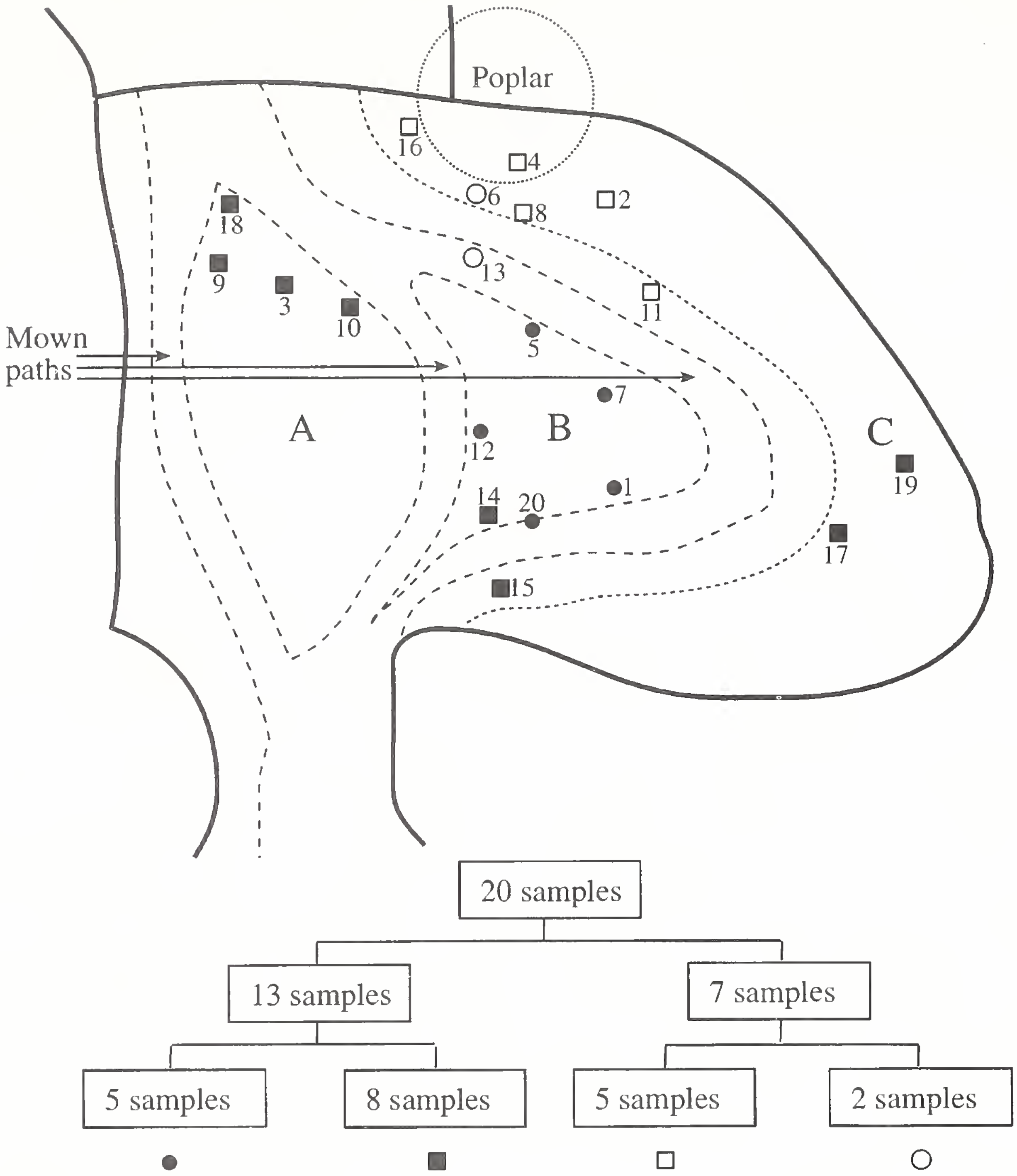

FIGURE 3. Diagram of meadow (S35) showing position of quadrats in relation to Twinspan endgroups. A — mowing ceased in October 1997; B — mowing ceased in July 1998; C — meadow margins (cut twice a year).

Provenance

An essential criterion for native conservation projects is the protection of local genetic variety between and within wild species. The importance of using seeds and plants from native sources is frequently stressed (e.g., Hill 1996, Gilbert and Anderson 1998, Verner 1998). There is evidence, moreover, that native species of local provenance establish, survive and grow better than foreign seed for amenity and conservation planting (Worrell 1992). In 1997 Flora Locale was established to tackle the problem of widespread use of imported plants for restoring native vegetation. In a series of technical guidance notes Flora Locale covers topics such as: definitions of British native-origin plants; putting back wild plants where they belong; codes of practice for collectors, suppliers and growers of wild plant gene stock; and buying native wild flowers, grasses, ferns, trees and shrubs (Flora Locale 1998). A list of specialist growers and suppliers is included in Appendix 2.

The Wildlife Garden was designed to meet this criterion of native provenance of plants and seeds. In spite of this however, several cultivars and non-native species were inadvertently planted in place of the specified native species. For example, much of the hazel originally planted is more robust and with larger leaves than the native *Corylus avellana*; several Corsican pine *Pinus nigra* appeared in place of Scots pine *Pinus sylvestris*. These are gradually being removed and replaced with plants from nurseries known to raise local or at least nationally native stock. Where they have not yet been replaced, the Museum's Wildlife Garden Guides and the Educational Explainers are able to illustrate this important issue to visitors and school children.

Use of the National Vegetation Classification (NVC)

The NVC allows vegetation to be classified in a standard way and is widely used to compare samples from different sites with standard NVC types, to assess the quality of habitats, and to provide an objective method for surveying. It also provides accessible data as a basis for habitat creation and was used in the design and specification of the Wildlife Garden. However, in a confined space where each habitat is a very small example and obviously vulnerable to edge influence, greater flexibility in creation, together with more intensive management, is needed to stem succession which may be initiated by aggressive community constants. For example, a large proportion of the pond-side meadow (M4/5) has in three years become dominated by cock's-foot *Dactylis glomerata*. In the woodland area the community species, bracken *Pteridium aquilinum*, was not even planted for fear of its invasive habit; similarly *Lemna* species were not added to the ponds. In addition, species that are common to more than one community, as for example, oxeye daisy *Leucanthemum vulgare* in all three grassland communities, need to be controlled in a least one of the meadows in order to maintain distinctiveness between the three types of grassland. Whilst therefore not following each NVC community composition slavishly, it has nevertheless proved invaluable as a guide to plant specification and subsequent management. Reference is made to individual NVC communities in the discussion of habitats below.

Description by habitat

WOODLAND

The principal woodland areas were designed to represent lowland mixed broadleaved woodland based on the NVC community W10 *Quercus robur–Pteridium aquilinum–Rubus fruticosus*. The major trees planted in 1994/5 throughout the main woodland areas were, as recommended (Rodwell and Patterson 1995): pedunculate oak *Quercus robur*, sessile oak *Quercus petraea* and silver birch *Betula pendula*, with hornbeam *Carpinus betulus* (S21), ash *Fraxinus excelsior* (S1 and 2) and field maple *Acer campestre* (S2 and 3). In many respects woodland was the most effective habitat to create because of the ready-made canopy offered by the plane trees. Structural diversity was successfully achieved by planting a range of tree sizes: standards, feathereds, whips and transplants. Many of the plants were donated. Additional whips and transplants were planted in subsequent years. Other species, including goat willow *Salix caprea* and wild cherry *Prunus avium*, replaced ornamental shrubs (see Management update, above). All tree species recorded in the survey had established well, in particular the faster growing pioneer species, silver birch and willow. The originally planted silver birch in some areas has reached over six metres in height. In spite of the dry conditions under the canopy of plane trees, few trees have died. Because of the need to restrict the canopy height (to avoid complete overshading of the garden), there is little space within the woodland to accommodate much of a shrub layer. Groups of hazel *Corylus avellana*, planted in 1994, fringe the path along the northern woodland area (S7 and 8) which is convenient for demonstrations of traditional hazel coppicing. Similarly, elder *Sambucus nigra*, dog rose *Rosa canina* and guelder rose *Viburnum opulus* are amongst shrubs grouped appropriately. The bramble, so characteristic of oak woodland community, is too competitive to be contained in the small woodland areas. However, honeysuckle *Lonicera periclymenum* was added to selective plots (S3, 5, 6) and common gorse *Ulex europaeus,* broom *Cytisus scoparius* and bog myrtle *Myrica gale* have been planted to provide the shrub layer in the transition to acid woodland fringing the heathland.

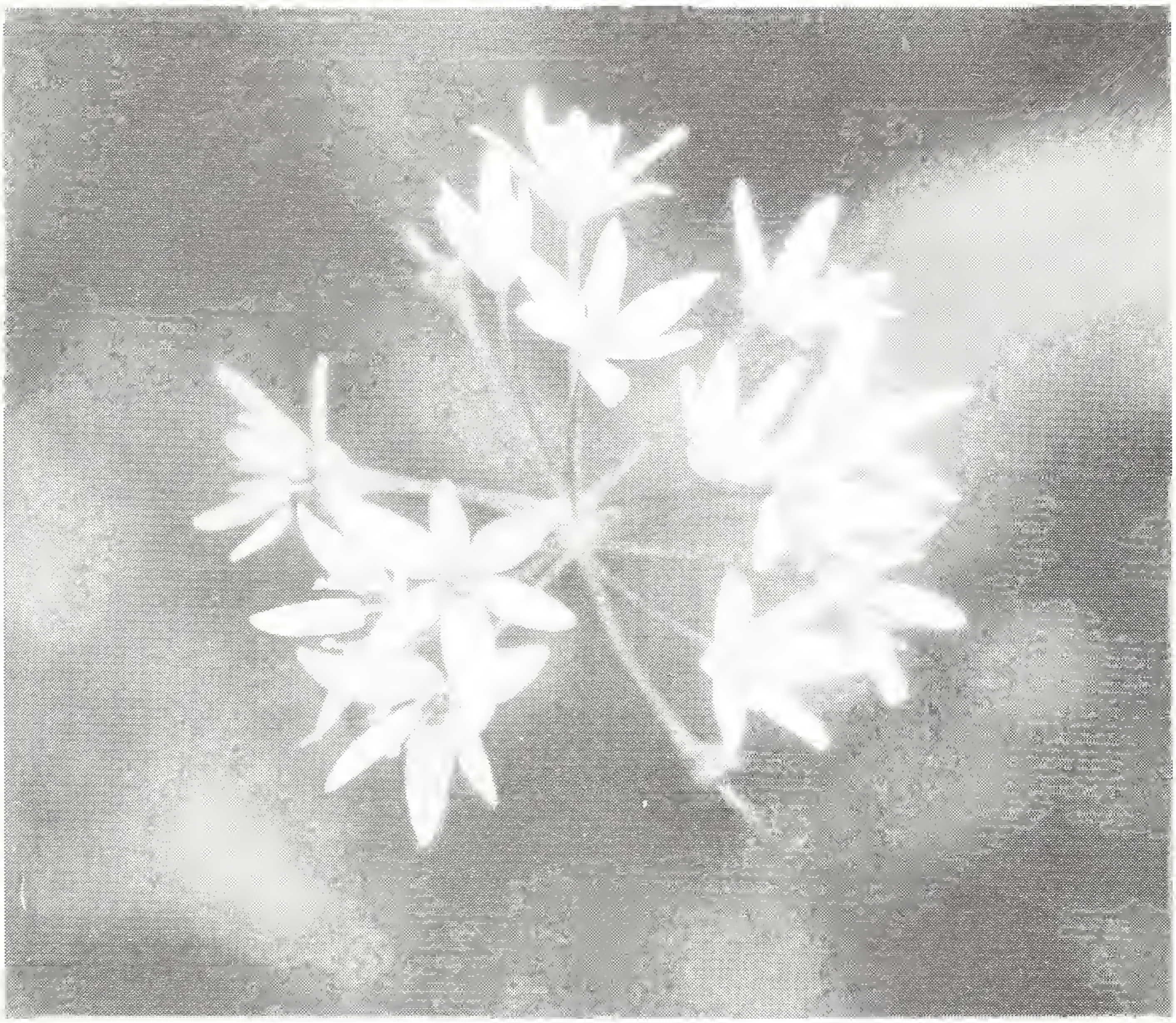

FIGURE 4. Ramsons *Allium ursinum* planted in 1998. *Photo: Sue Snell*

The woodland was designed to show distinct ground flora communities and areas S7 and S8 were planted with bluebell *Hyacinthoides non-scripta* and wood anemone *Anemone nemorosa* respectively. An ivy *Hedera helix* sub-community is also represented, though this was reduced in 1997 and replanted with the less invasive and more colourful native bluebells. Primrose *Primula vulgaris,* which was contained in the original seed mix, is particularly abundant along the southern woodland areas. The even more abundant red campion *Silene dioica* was recorded in fifteen plots and a few plants were found flowering for almost twelve months of the year in woodland, hedgerow and many areas fringing the pathways. The development of other woodland ground flora suffers a setback each autumn however, as the disturbance caused by the leaf raking creates opportunities for unwanted weedy species such as fat hen *Chenopodium album* and Canadian fleabane *Conyza canadensis.* Many of the species sown as seeds in 1994 were not recorded in 1998. These included cow parsley *Anthriscus sylvestris,* dog's mercury *Mercurialis perennis,* greater stitchwort *Stellaria holostea,* yellow pimpernel *Lysimachia nemorum,* and sanicle *Sanicula europaea.* The first two of these species were added as plants and rhizomes in woodland areas in March 1998 and November 1998 respectively and both were flowering in April 1999. The third, greater stitchwort, was planted as plugs in spring 1998 but has not been recorded to date. The woodland mix sown in April 1998 (see Management update, above) contained all five of these species and it will be interesting to note whether or not they appear this spring (1999). Additional ground flora in the form of plants, bulbs and rhizomes (mostly donations) were planted in selected woodland areas (S5, 6, 7, 8, 10) in autumn 1997 and during 1998; these included wood sage *Teucrium scorodonia,* ramsons *Allium ursinum* (Figure 4), celandine *Ranunculus ficaria* and, in the southern woodland areas (S18, 20, 21, P1), lords and ladies *Arum maculatum* and cow parsley *Anthriscus sylvestris.*

Grasses which have performed particularly well from seed include: cock's-foot *Dactylis glomerata,* tufted hair-grass *Deschampsia cespitosa,* Yorkshire fog *Holcus lanatus,* and false brome *Brachypodium sylvaticum.* The attractive wood mellick *Melica uniflora* occurs around the periphery and in woodland and scrub areas (P1, S16, S18), but there are no records of it having been deliberately introduced.

An additional woodland community of beech *Fagus sylvatica* was planted to the north of the chalk pond to which yew *Taxus baccata* has been added. The ground flora under the beech and adjoining ash 'plantation' was dominated by creeping buttercup *Ranunculus repens* and great willowherb *Epilobium hirsutum,* but recently planted dog's mercury *Mercurialis perennis* and ramsons *Allium ursinum* should spread into these areas.

Typical willow carr is represented by groups of willow and alder planted around two of the ponds and these are coppiced to prevent overshading of the water.

SCRUB

There are two areas of scrub which attract a variety of wildlife as well as illustrating the effects of succession. On the predominantly bramble mound (S16), a total of forty-seven species of flowering plants was recorded. This included a diversity of urban colonizers such as butterfly bush *Buddleja davidii,* willowherb species *Epilobium hirsutum, E. parviflorum, E. roseum* and *E. tetragonum,* Canadian and Guernsey fleabane *Conyza canadensis* and *C. sumatrensis,* as well as colonizers from other habitats in the Wildlife Garden including brooklime *Veronica beccabunga,* hemp agrimony *Eupatorium cannabinum,* and oxeye daisy *Leucanthemum vulgare.* Apart from restraining the bramble from the pathways and removing most of the creeping thistle *Cirsium arvense* and selective seed heads of other species, this area is left unmanaged and should provide some interesting results over the next few years.

The second scrub area (S1), between the chalk grassland and beech *Fagus sylvatica* and yew *Taxas baccata* woodland area, has been closely monitored since 1996 and is largely dominated by cock's-foot *Dactylis glomerata,* though includes juniper *Juniperis communis,* common bird's-foot trefoil *Lotus corniculatus* and red clover *Trifolium pratense* and creeping thistle *Cirsium arvense.* Tor-grass *Brachypodium pinnatum* and some shrub species (e.g., hawthorn *Crataegus monogyna*) are to be planted in spring 1999 to replace much of the cock's-foot in order to represent unmanaged chalk grassland/scrub succession.

HEDGES

Hedgerows are an important element of the British landscape and provide valuable habitats for wildlife. In the overall design of the Wildlife Garden they have been used to fringe the main fire access path and to divide areas to create 'outdoor rooms'. Rather than follow a specific NVC community, the species composition of the hedgerows was taken from those found bordering Mapletree Lane, Writtle Forest, Essex. Although hedge laying was not normally carried out in Essex forests, two of the hedges (H2 and 4) which contain seven and six shrub species respectively have been laid to illustrate the traditional skill of hedge laying in the garden. Two shorter hedges (H3 and 5) are single-species coppiced hedges. One of the laid hedges, (H2) under the canopy of the plane trees, has suffered from drought and is very gappy. Flowering plants on the hedge banks include: false brome *Brachypodium sylvaticum,* tufted hair-grass *Deschampsia cespitosa,* Yorkshire fog *Holcus lanatus* and red campion *Silene dioica,* primrose *Primula vulgaris,* nettle-leaved bell flower *Campanula trachelium,* garlic mustard *Alliaria petiolata* (Figure 5), tufted and common vetch *Vicia cracca* and *V. sativa* and the more recently added lords and ladies *Arum maculatum,* celandine *Ranunculus ficaria,* cow parsley *Anthriscus sylvestris,* common dog violet *Viola riviniana,* upright hedge parsley *Torilis japonica* and ramsons *Allium ursinum.* It is planned to remove the tufted hair-grass and introduce other species of flowering plant. The most recently planted hedge (H6, January 1998), comprises six shrub species and will provide a screen from the compost area.

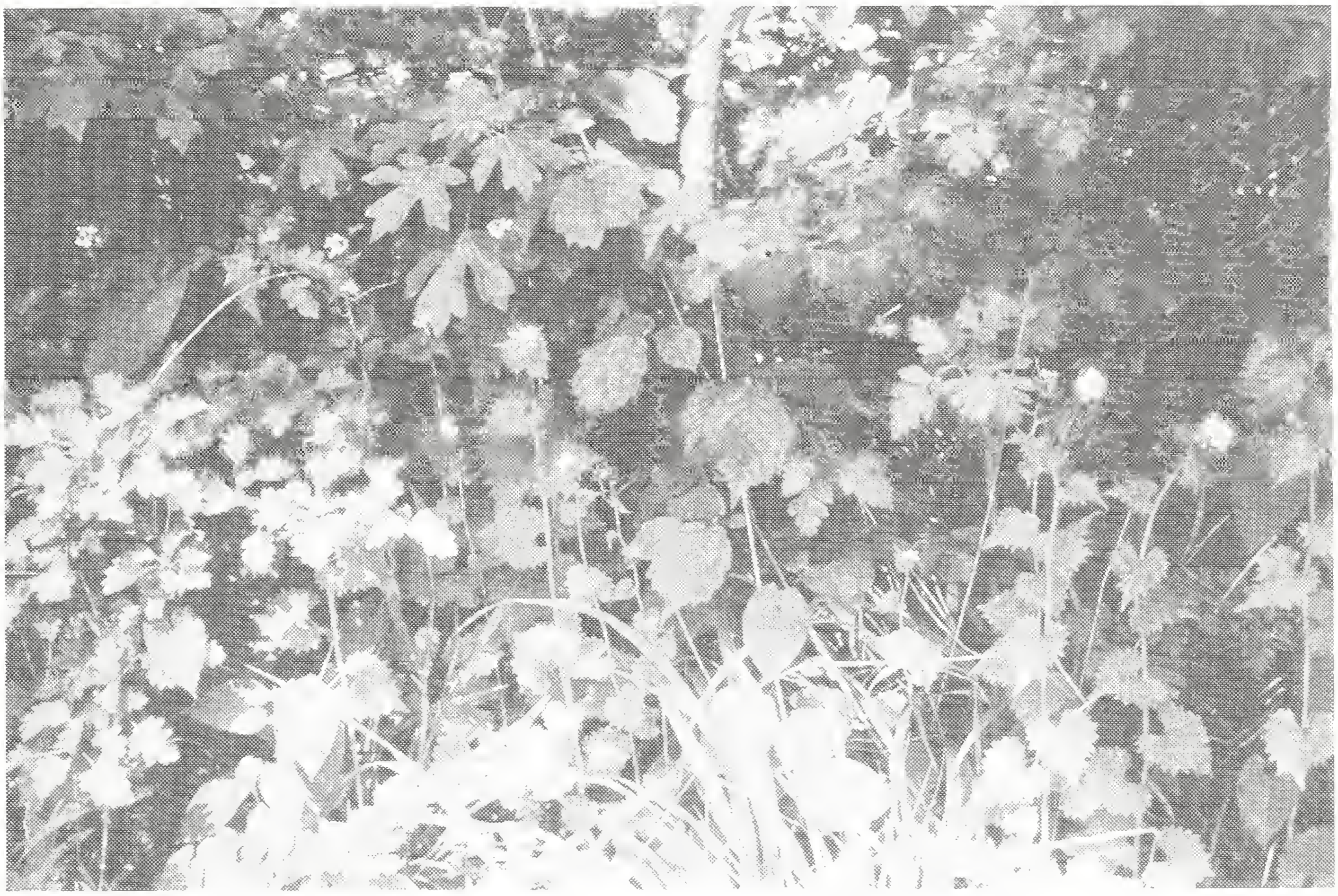

FIGURE 5. Garlic mustard *Alliaria petiolata* regenerates well by seed in the hedgerow.
Photo: Derek Adams

GRASSLAND

a. Meadows

In the meadow (S35), the correlation, albeit poor, with the NVC community MG7 was not surprising given the dominance of perennial rye-grass *Lolium perenne* and white clover *Trifolium repens.* Many of the fifty species recorded in the meadow were not typical meadow species and included Canadian and Guernsey fleabane *Conyza canadensis* and *C. sumatrensis,* willowherb *Epilobium* species, teasel *Dipsacus fullonum* and common mallow *Malva sylvestris,* a reflection of the recently disturbed soils. Originally conceived as a meadow surrounding an amenity/teaching lawn, the whole area is now being steered in the direction of neutral grassland (hay meadow) NVC community MG5 *Cynosurus cristatus–Centaurea nigra* using well-known methods of diversifying grassland such as adding plants and experimenting with mowing regimes to reduce soil fertility. Flowers which have already performed well are those which tolerate medium to high fertility such as oxeye daisy *Leucanthemum vulgare,* yarrow *Achillea millefolium,* meadow cranesbill *Geranium pratense* and betony *Stachys officinalis.* These were planted on the outer fringes of the meadow as either plugs or pots in the spring of 1995. Community constants, meadow vetchling *Lathyrus pratensis,* common birds-foot trefoil *Lotus corniculatus* and red clover *Trifolium pratense,* were added as plug plants in June 1998 to provide additional colour. Seeds of yellow rattle *Rhinanthus minor* which is semi-parasitic on most grass species, were sown and raked into bare patches in autumn 1998 with the aim of breaking down areas of rye grass. In spring 1999 additional planting took place of other species characteristic of hay meadows including common knapweed *Centaurea nigra,* meadow and bulbous buttercup *Ranunculus acris* and *R. bulbosus* and grasses such as red fescue *Festuca rubra* and crested dog's-tail *Cynosurus cristatus.* Small pieces of turf were removed before adding the plants from plugs and 5-cm pots (Figure 6).

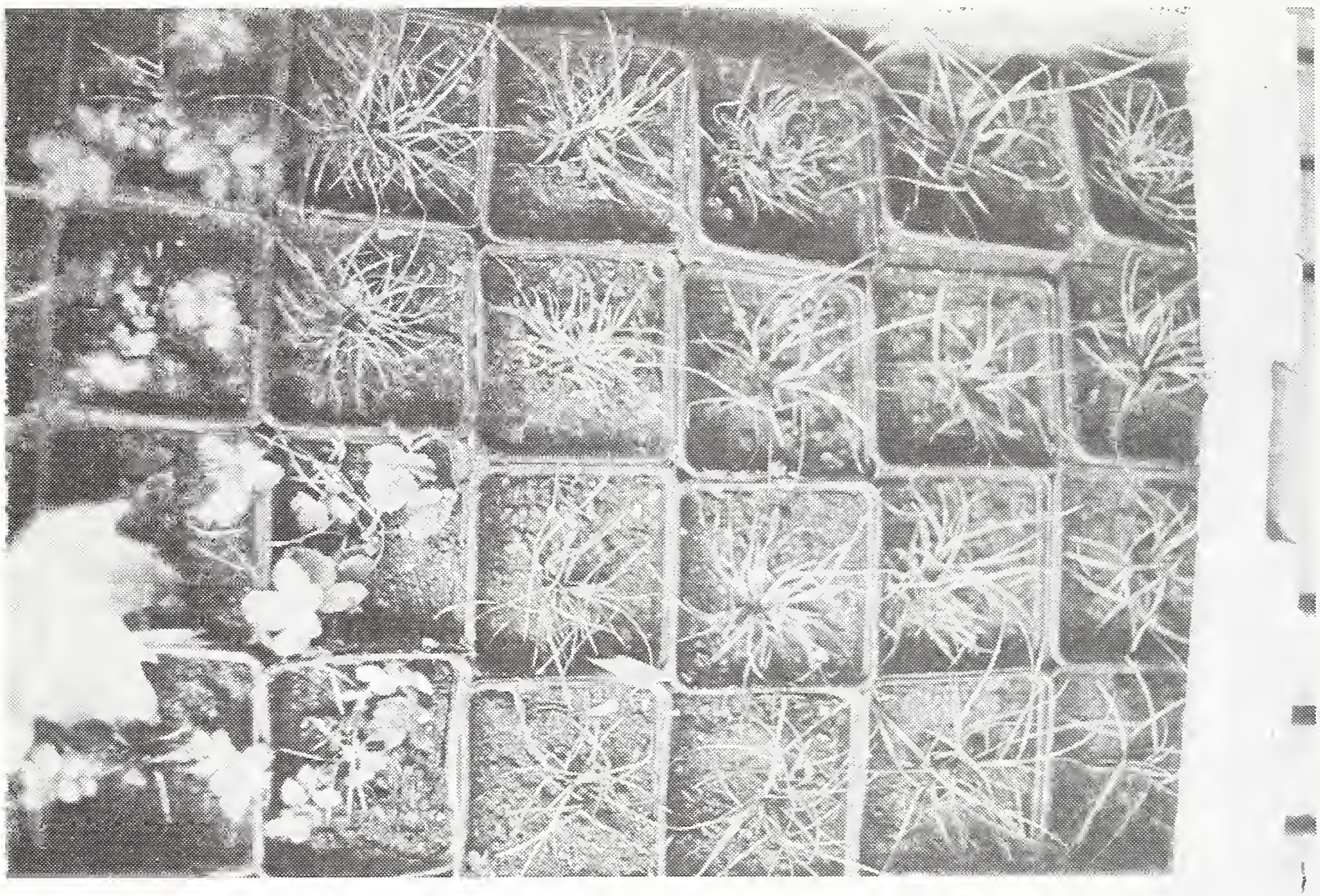

FIGURE 6. Meadow plants from British Wild Flower Plants ready for planting.
Photo: Sue Snell

Quadrat analysis will be carried out regularly to monitor changes, particularly with respect to the NVC.

The second meadow area (M4, M5) extends from the top of the south-facing bank down to the margins of the main pond. This area, treated as two beds in the initial planting scheme, has been monitored each year since 1995; it contains a richer mix of species than the above 'hay meadow'. The area was based originally on mesotrophic grassland NVC community MG4 *Alopecurus pratensis–Sanguisorba officinalis,* a community characteristic of traditionally treated alluvial meadow. There are two distinct areas, M4 and M5, sown in 1994 with two different seed mixes. One contained 75 per cent by weight of grasses including 20 per cent of cock's-foot *Dactylis glomerata;* the other seed mix contained 55 per cent by weight of grasses (plus 10 per cent rushes) including 15 per cent red fescue *Festuca rubra* and 15 per cent meadow foxtail *Alopecurus pratensis.* In the former, cock's-foot is the dominant plant, with some common bird's-foot trefoil *Lotus corniculatus* and bladder campion *Silene vulgaris.* In the latter area, although red fescue *Festuca rubra* is dominant, this is not to the exclusion of other grasses such as crested dog's-tail, and there are thirty-five species of broadleaved plants. Ribwort plantain *Plantago lanceolata* is locally dominant (>100 plants). This is consistent with the NVC description 'of rosette species including *Leontodon autumnalis, L. hispidus, Bellis perennis,* and *Plantago lanceolata* as being prominent in the short sward' (Rodwell 1992). The prominence of ribwort plantain here, however, is to the exclusion of most of the other rosette species in spite of efforts to impede its progress. This may be due both to the high percentage in the original seed mix (5 per cent) as well as the considerable regenerative capacity of this species. Other species recorded, which are also present in NVC community MG5 include small amounts of quaking-grass *Briza media*, meadow buttercup *Ranunculus acris*, common bird's-foot trefoil, selfheal *Prunella vulgaris*, and meadowsweet *Filipendula vulgaris*. One large fennel *Foeniculum vulgare* plant has been recorded since 1997. Several species have disappeared since 1997 including devil's-bit scabious *Succisa pratensis* which was planted as well as seeded into the area in 1995 and skullcap *Scutellaria galericulata*, recorded in 1997. Some fine tuning is required to help encourage more of the community flowers, and plants of cuckoo flower *Cardamine pratensis*, great burnet *Sanguisorba officinalis* meadow buttercup, red clover and additional meadowsweet have been added in gaps created by weeding out some of the ribwort plantain and ragwort *Senecio jacobaea*. Since cock's-foot spreads mainly by seed, more-frequent mowing is needed to target that particular species.

b. Chalk grassland

The area representing chalk downland (M1) was formed from chalk substrate and topsoil donated by the Hursley Estate from an old chalk quarry near Winchester in Hampshire. The chalk grassland, an area of approximately 300 sq m, was designed to emulate NVC chalk grassland community CG2 *Avenula pratensis–Festuca ovina*. The number of species recorded in the survey was seventy-two. This compares with twenty-two species contained in the original seed mix with additional species planted as plugs and six shrub species. The dominant species recorded were yarrow *Achillea millefolium*, rough hawkbit *Leontodon hispidus*, oxeye daisy and red fescue, perennial ryegrass *Lolium perenne* at >100 plants, with lady's bedstraw *Galium verum*, wild marjoram *Origanum vulgare*, ribwort plantain *Plantago lanceolata*, small scabious *Scabiosa columbaris*, common bent *Agrostis capillaris* and hedge bedstraw *Galium mollugo* occurring at between fifty to a hundred plants. Salad burnet *Sanguisorba minor* and kidney vetch *Anthyllis vulneraria* are locally abundant. The abundance of perennial ryegrass and white clover *Trifolium repens* at the base of the 'downland' is probably due to the spread of these species from the original turf placed along all path edges. A number of non-typical chalk grassland plants have exploited bare areas on the shady north and east sides of the slope. These include buddleia *Buddleja davidii* from the adjoining urban habitat, creeping thistle *Cirsium arvense*, common nettle *Urtica dioica* and coltsfoot *Tussilago farfara*. Plug plants of thyme *Thymus polytrichus* and glaucous sedge *Carex flacca* were added in December 1997; quaking-grass *Briza media*, dwarf thistle *Cirsium acaule* and rock rose *Helianthemum nummularium* were planted the following spring/summer. More recently, additional plants of sheep's fescue *Festuca ovina* have been added together with meadow oat-grass *Helictotrichon pratense* and yellow wort *Blackstonia perfoliata*. Now that the most characteristic species of the community are included appropriate management is needed to ensure their survival. Sheep grazing is being considered.

HEATHLAND

The heathland area had originally been planted with heather *Calluna vulgaris*, bell heather *Erica cinerea*, common gorse *Ulex europaeus* and both Scots pine *Pinus sylvestris* and Corsican pine *Pinus nigra* (see note on Provenance, above). By the end of 1997 the number of plants was insufficient to make much impact and the area was targeted for restoration in early 1998. The most effective method for the reconstruction of heathland has been shown to be obtained by translocation of turfs from existing heathland to the new site (Pyewell, Webb and Putwain 1995). We were fortunate enough to have the benefit of the advice of Nigel Webb (ITE) and Phil Sterling (County ecologist Dorset County Council) together with a donor site and the expertise and machinery of Will Bond and his team, Alaska Environmental Contracting. The donor site was Merritown Heath in east Dorset. The heathland area was created by scraping off a layer of topsoil and replacing this with ten tonnes of heathland subsoil and placing closely fitting turfs (1.2 × 2.4 m) to form a continuous 60 sq m of heath (Figure 7). The bell heather was the first to flower (June) followed by the heather and dwarf gorse. The heathland community corresponds with NVC H3 *Agrostis curtisii–Ulex minor.* Seeds of bristle bent *Agrostis curtisii* have since been added to the surrounding areas to complete the community. The heathland plot is exposed to a particularly hostile environment: next to one of the most traffic-polluted road junctions in London, in partial shade of London plane trees, and at some point in the winter months covered in plane-tree leaves. It will be interesting to see how long it survives. We intend to demonstrate heathland management in one form once it survives another season's growth; some areas will be cut, but probably not burned! In the meantime, on Merritown Heath, sand lizards have been reported taking advantage of the resulting gaps created by the removal of the turfs and solitary wasps have also taken up residence in the bare sandy areas.

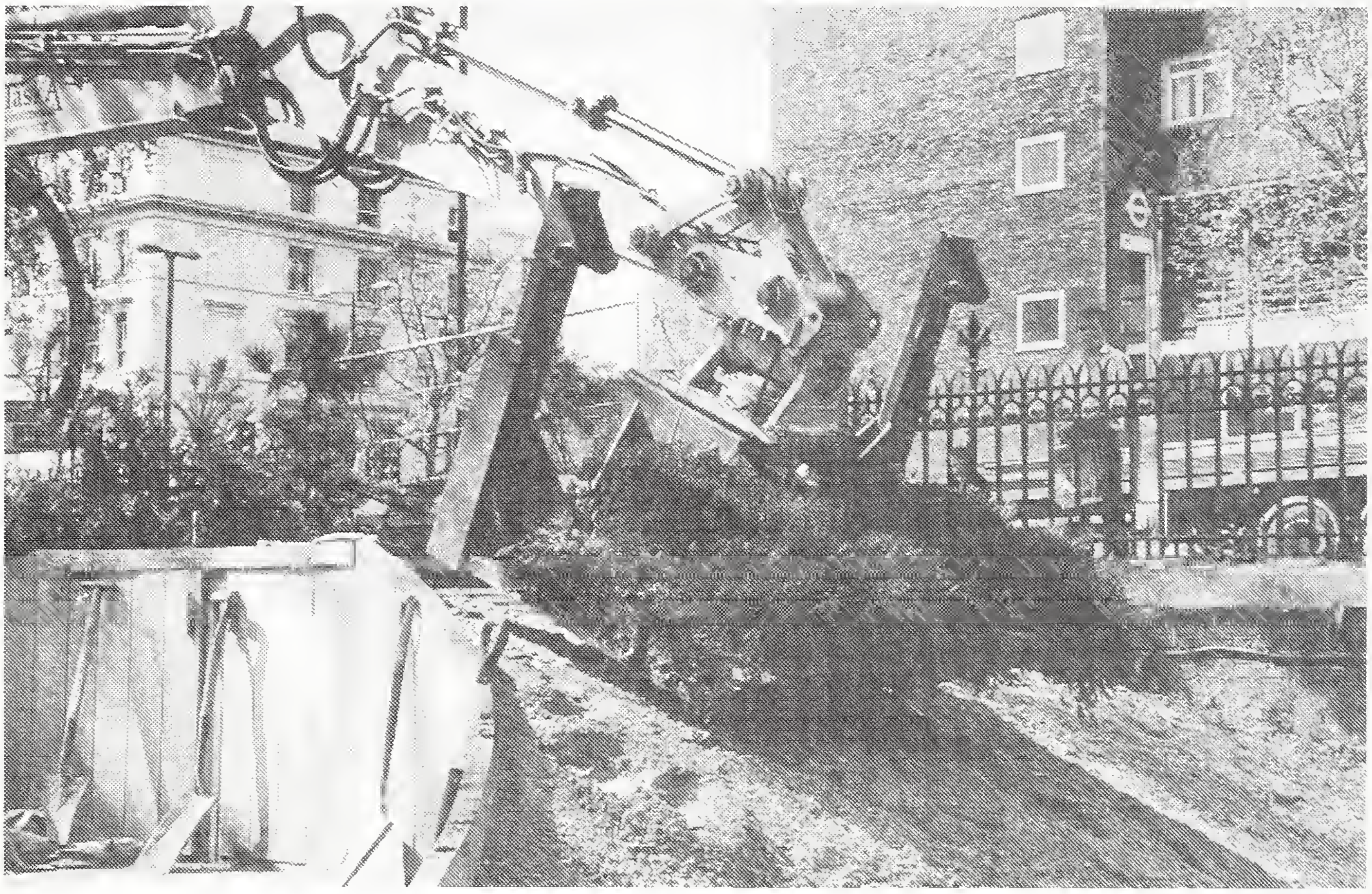

FIGURE 7. Restoration of the heathland in April 1998. *Photo: Caroline Ware*

WETLAND AREAS

Wetland areas are represented by three ponds, marginal and bank vegetation along the pond edges as well as an area of fen and reedbed. A wet heathland area has been added very recently (see Management update, above).

a. Pond: aquatic and marginal species

The three ponds previously described (Honey et al. 1998: 20) are intended to represent distinct types of pond. The chalk pond (W14) which has a pH of 8.0, contains large quantities (>100) of spiked water-milfoil *Myriophyllum spicatum* as well as curled pondweed *Potamogeton crispus* which is thought to have been introduced accidentally with other aquatics. There were seven emergent species including bog bean *Menyanthes trifoliata* (which should, more appropriately be found around the 'acid' pond (W16)). All aquatics and emergents have been recorded annually since 1996. The main pond (W15) which has a pH of 7.5, contained large amounts of Canadian pondweed *Elodea canadensis* as well as some rigid hornwort *Ceratophyllum demersum*, curled pondweed and white water lily *Nymphaea alba*. As already indicated above, blanket weed is a problem in this pond. Regular raking out of blanket weed has inevitably included removal of many aquatic plants, i.e., those recorded in 1996 but no longer present in 1998. In future, raking will cease and additional aquatic plants are to be added in the hope that they will out compete the blanket weed. Common duckweed *Lemna minor* has found its way into the main and top pond (W16). The top pond, representing more acidic conditions, has suffered several setbacks due to a leak which proved difficult to locate. It has therefore been subjected to a large quantity of mains water and the recorded pH was 7.4. Two acid-loving species added in July 1998, quillwort *Isoetes lacustris* and floating water plantain *Luronium natans* have not survived. The one abundant aquatic recorded in the top pond (W16) was curled pondweed. Previous records (1996) show rigid hornwort and spiked water-milfoil but these have not survived drying out (the pond was emptied during the search for the leak). Emergent vegetation in the top pond included bog bean and water horsetail *Equisetum fluviatile*.

Marginal and bank vegetation common to all three ponds included figworts *Scrophularia nodosa* and *S. auriculata*, purple loosestrife *Lythrum salicaria*, and wild angelica *Angelica sylvestris*. Marsh marigold *Caltha palustris*, brooklime *Veronica beccabunga*, water mint *Mentha aquatica*, water forget-me-not *Myosotis scorpioides* and yellow iris *Iris pseudacorus* were all common to the chalk and main pond. Rushes and sedges were represented by soft and hard rush *Juncus effusus* and *J. inflexus* around all three ponds and greater tussock sedge *Carex paniculata*, tufted sedge *Carex elata* and greater pond-sedge *Carex riparia* around the main pond. The less desirable and invasive galingale *Cyperus longus* was also abundant around the main pond. The vegetation has produced sufficient cover to provide a nesting area for a mallard.

b. Fen

The fen area (W4) contained a total of thirty-five species, many of which were introduced with a piece of fen vegetation donated by the RSPB and brought from Strumpshaw Fen Nature Reserve in March 1997. The scrapes created by the removal of these plants were for the benefit of the bitterns on the nature reserve. The plant species included common reed *Phragmites australis*, marsh fern *Thelypteris palustris*, fen nettle *Urtica galeopsifolia* and common fleabane *Pulicaria dysenterica* and tufted sedge *Carex elata*. Other species in the fen area include the abundant hemp agrimony *Eupatorium cannabinum*, common meadow-rue *Thalictrum flavum*, and marsh marigold *Caltha palustris*, all continuously recorded since 1996. Additional species such as marsh pennywort *Hydrocotyle vulgaris*, great fen-sedge *Cladium mariscus* and marsh thistle *Cirsium palustre* were brought in from Wicken Fen in April 1998. Several clumps of tufted hair-grass *Deschampsia cespitosa* look striking but are inappropriate in this fen community and will be transferred to woodland areas to make room for additional clay liner which will accommodate more fen vegetation.

c. Reedbed

The reedbed (W5–7), planted as a pure stand of common reed *Phragmites australis*, is frequently weeded of opportunists quick to exploit gaps around the developing reed. Species which have attempted to colonize the bed include marsh marigold *Caltha palustris*, water figwort *Scrophularia auriculata*, great willowherb *Epilobium hirsutum*, which is abundant around the edges, and monkey flower *Mimulus guttatus*.

URBAN HABITAT, ACCIDENTAL ARRIVALS AND CULTIVARS

The wildlife value of urban habitats in their own right is increasingly recognized and, in some instances fiercely defended, as at Gargoyle Wharf in London (Frith 1996). An urban habitat area was allocated a small space on the north-east fringe of the garden (M3) in which twenty-nine species were recorded. Species which commonly form urban plant communities are not easily contained however and sometimes compete for space in the native habitat areas. Many have colonized the bare ground remaining after the autumn leaf rake; these include species of Chenopodiaceae: *Atriplex prostrata, A. patula, Chenopodium album, C. polyspermum* and *C. hybridum,* willowherb *Epilobium* species, *Chamerion angustifolium, Conyza canadensis* and *C. sumatrensis* and groundsel *Senecio vulgaris.*

Other species which may be considered weeds in most gardens are constituents of NVC communities and valuable food plants, but may have to be controlled by weeding before they become too invasive. These include common nettle *Urtica dioica,* creeping thistle *Cirsium arvense* and spear thistle *Cirsium vulgare,* ribwort plantain *Plantago lanceolata,* common ragwort *Senecio jacobaea* and hedge bindweed *Calystegia sepium.* Accidental arrivals included hoary mustard *Hirschfeldia incana* and Guernsey fleabane *Conyza sumatrensis,* plants characteristic of local habitats such as nearby parks 'spreading through London and beyond' (Wiltshire 1994: 45). A total of thirty-four so-called weedy and alien species was recorded in the garden overall in 1998.

Several cultivars or garden escapes have found their way into the garden possibly attached to other plant material. These include golden rod *Solidago canadensis,* dame's violet *Hesperis matronalis,* fox and cubs *Pilosella aurantiacum,* and Spanish bluebell *Hyacinthoides hispanica.* Other cultivars, mainly shrubs and trees, are relics of the previous garden that continue to provide good bird cover, although the lilac at the edge of the meadow looks somewhat out of place. Shrub species include mock orange *Philadelphus coronarius,* spotted laurel *Aucuba japonica,* shiny privet *Ligustrum lucidum,* holly *Ilex aquifolium* and laburnum *Laburnum anagyroides.* Mature trees include London plane *Platanus* × *hispanicus,* Lombardy poplar *Populus* cv, small-leaved lime *Tilia cordata* and horse chestnut *Aesculus hippocastanum.*

Problems of edge influence: strategies of individual species

Encroachment of rapidly spreading species threatens the identity of the individual habitats we are trying to represent. Not all of the species are natural colonizers or accidental arrivals however. The most commonly occurring species together with their method of introduction, where known, are shown in Table 2.

TABLE 2. Species occurring in fifteen or more plots within the Wildlife Garden.

Species	Number of plots in which species occur	Method of introduction
Plantago lanceolata	28	Seed mix
Holcus lanatus	25	Seed mix
Dipsacus fullonum	24	Plants
Achillea millefolium	23	Plants
Urtica dioica	22	Accidental arrival/seed bank
Galium mollugo	22	Seed mix and plants
Ranunculus repens	21	Seed mix
Leucanthemum vulgare	20	Seed mix and plants
Prunella vulgaris	19	Seed mix
Taraxacum officinale agg.	18	Accidental arrival/seed bank
Agrostis capillaris	18	Seed mix
Epilobium hirsutum	15	Accidental arrival/seed bank
Silene dioica	15	Seed mix and plants
Potentilla reptans	15	Accidental arrival/seed bank
Cirsium arvense	15	Accidental arrival/seed bank
Agrostis stolonifera	15	Seed mix

All but the most vigorous species, common nettle *Urtica dioica,* creeping thistle *Cirsium arvense,* great willowherb *Epilobium hirsutum,* creeping cinquefoil *Potentilla reptans* and dandelion *Taraxacum* species were introduced in seed mixes and as plug plants. The presence of competitors rather than the quickly growing/spreading ruderal species is due to the relative ease of weeding out the latter, e.g., groundsel *Senecio vulgaris,* knotgrass *Polygonum aviculare,* compared to the former with their vigorous root system. Many will have been introduced during construction and soil movement within the garden.

Some of the seed mixes available are designed for the creation and enhancement of habitats covering a greater area than ours; at the same time our wildlife garden, at one acre, is larger than many domestic gardens, certainly in urban areas. Lessons may be learnt by studying the performance of species which have spread quickly across the garden, such as ribwort plantain *Plantago lanceolata* and hedge bedstraw *Galium mollugo,* and appropriate adjustments made to wildflower seed mixes for small gardens. Some of these species, including ribwort plantain, would anyway naturally colonize the area and should be deliberately introduced with caution or maybe not at all.

Soil fertility is a problem in most gardens and is illustrated in some of the habitats above. Plants which are happy with high fertility have performed well, e.g., oxeye daisy *Leucanthemum vulgare,* red campion *Silene dioica,* selfheal *Prunella vulgaris* and teasel *Dipsacus fullonum* (Figure 8), whilst those plants with a preference for low fertility, such as harebell *Campanula rotundifolia,* are clinging tenaciously to the edges. Other less-desirable indicators of soil fertility are common nettle and creeping buttercup *Ranunculus repens,* the latter perhaps needlessly deliberately introduced!

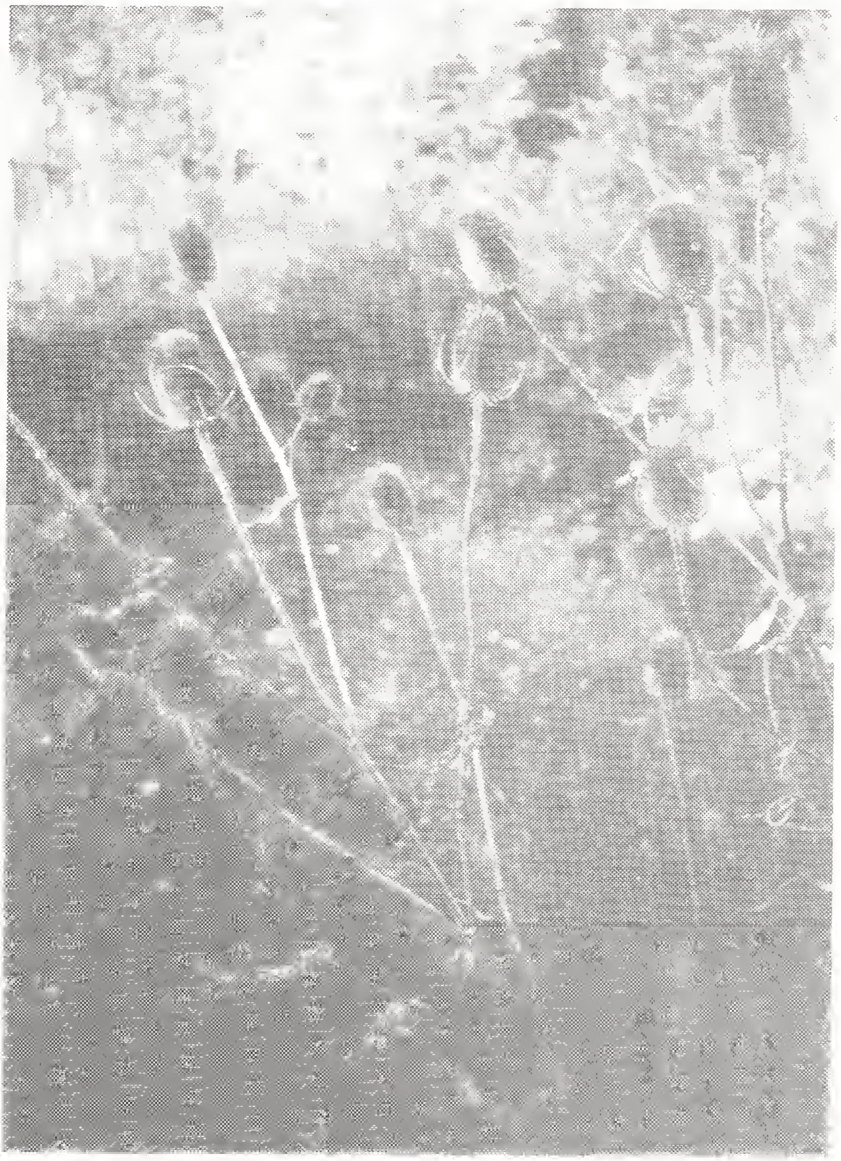

FIGURE 8. Wild teasel *Dipsacus fullonum* has spread rapidly across the garden, and provides food for bumblebees, brimstone butterflies and goldfinches. *Photo: Sue Snell*

Conclusion

The survey has highlighted some of the problems encountered in developing and maintaining the distinctiveness of several different habitat types, all of which naturally have very specific requirements of soil, water, climate and other environmental factors. It is too early to gauge fully the response to different techniques of habitat creation, i.e., seeds, plugs, or fragments of vegetation. However, the latter method does have considerable advantage where there are factors which are difficult to replicate such as soil requirements. Regular monitoring of vascular plants in the Wildlife Garden is an essential management tool and provides an unusual learning ground for people to identify and study plants which occur naturally in habitats throughout lowland Britain in addition to the fauna they support.

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References

(Including other works consulted during the survey)

FLORA LOCALE. 1998. New technical guidance note. *Plant User: Landlines.* Issue 23. Landscape Design Trust.

FRITH, M. 1996. Gargoyle Wharf bulldozed. *Wildlife Network.* Newsletter for London Wildlife Trust Volunteers. October.

GILBERT, O.L. and ANDERSON, P. 1998. *Habitat creation and repair.* Oxford University Press.

GRIME, J.P. 1977. *Plant strategies and vegetation processes.* Wiley.

HILL, F. 1996. *Wildlife gardening: a practical handbook.* Ed.3. Derbyshire Wildlife Trust.

HONEY, M.R., LEIGH, C. and BROOKS, S.J. 1998. The fauna and flora of the newly created Wildlife Garden in the grounds of The Natural History Museum, London. *Lond.Nat* **77**: 17–47.

HUBBARD, C.E. 1984. *Grasses.* Ed.3. Penguin Books, London.

KENT, M. and COKER, P. 1992. *Vegetation description and analysis.* Bellhaven Press, London.

MARTIN, D. 1999. *Relative sensitivity of algal species to inhibitors from plant litter.* Unpublished Ph.D. thesis, The Open University.

PYEWELL, R.F., WEBB, N.R. and PUTWAIN, P.D. 1995. A comparison of techniques for restoring heathland on abandoned farmland. *J. appl. Ecol.* **32**: 400–411.

RICH, T.C.G. and JERMY, A.C. *Plant Crib 1998.* BSBI, London.

RODWELL, J.S. (ed.) 1992. *British plant communities.* **1** *Woodlands and scrub,* **2** *Mires and heaths,* **3** *Grasslands and montane communities.* Cambridge University Press.
RODWELL, J. and PATTERSON, G. 1995. *Creating new native woodlands.* The Forestry Commission, Bulletin 12. HMSO, London.
ROSE, F. 1981. *The wild flower key.* Frederick Warne, Penguin, London.
STACE, C. 1997. *New flora of the British Isles.* Ed. 2. Cambridge University Press.
VERNER, Y. 1998. *Creating a flower meadow.* Green Books, Totnes.
WILTSHIRE, E. 1984. The flora of Hyde Park and Kensington Gardens. *Lond. Nat.* **73**: 37–60.
WORRELL, R. 1992. A comparison between European continental and British provenances of some British native trees: growth, survival and stem form. *Forestry* **65**: 253–280.

APPENDIX 1

Species and habitat code numbers in which they occur.

	ACERACEAE	
Acer campestre	field maple	H2, H4, S2
Acer pseudoplatanus	sycamore	S5
	ALISMATACEAE	
Alisma plantago-aquatica	water plantain	W8, W10, W13
Luronium natans	floating water plantain	W16
Sagittaria sagittifolia	arrowhead	W15
	APIACEAE	
Aegopodium podagraria	ground-elder	H5
Aethusa cynapium	fool's parsley	M5, S3, S5, S7
Angelica sylvestris	wild angelica	S9, W4, W8, W9, W11, W13, W14
Anthriscus caucalis	bur parsley	H2
Anthriscus sylvestris	cow parsley	H4, H5
Berula erecta	lesser water parsnip	W8, W14, W15
Cicuta virosa	cowbane	W13
Daucus carota ssp.	wild carrot	H3, M1, M3, M4, S1, S3, S5, S8, S10, S11, S30, S35
Foeniculum vulgare	fennel	M4
Heracleum sphondylium	hogweed	H4, H5, M1, M4, M5, S3, S5, S8, S10, S35, W8, W13
Hydrocotyle vulgaris	marsh pennywort	W4
Peucedanum palustre	milk parsley	W13
Sison amomum	stone parsley	M5
Torilis japonica	upright hedge parsley	H2, H4
	AQUIFOLIACEAE	
Ilex aquifolium	holly	H2, M3, S2, S3, S5, S6, S7, S8, S10, S21, S35, W1
	ARACEAE	
Arum maculatum	lords and ladies	H5
	ARALIACEAE	
Hedera helix	ivy	H1, H4, M1, M3, S6, S9, S10, S16, S21, S27
	ASPLENIACEAE	
Phyllitis scolopendrium	hart's tongue	S16, S18, S19

ASTERACEAE

Achillea millefolium	yarrow	H2, H4, M1, M3, M4, M5, S1, S2, S3, S5, S6, S9, S10, S11, S24, S27, S28, S30, S35, W8, W9, W11, W12
Arctium minus	lesser burdock	M4, S2
Artemisia vulgaris	mugwort	M1, M3, M4, M5, S2, S21, S27, W1, W4, W10, W12, W13
Bellis perennis	daisy	S35
Centaurea nigra	common knapweed	M1, S11
Centaurea scabiosa	greater knapweed	M1
Cirsium acaule	dwarf thistle	M1
Cirsium arvense	creeping thistle	M1, M4, M5, S1, S2, S5, S7, S8, S11, W4, W8, W9, W11, W12, W13
Cirsium palustre	marsh thistle	W4
Cirsium vulgare	spear thistle	H2, S5, S35
Conyza canadensis	Canadian fleabane	M1, S3, S5, S16, S21
Conyza sumatrensis	Guernsey fleabane	S3, S5, S7, S11, S16, S28, S35, W11
Crepis biennis	rough hawk's-beard	H4
Eupatorium cannabinum	hemp agrimony	H5, S3, S16, S24, S28, S30, W1, W4
Hypochaeris radicata	cat's-ear	M4, S35
Lactuca serriola	prickly lettuce	S16
Lapsana communis	nipplewort	H4, S3, S5, S6, S23, S24
Leontodon autumnalis	autumn hawkbit	S2
Leontodon hispidus	rough hawkbit	M1, M3, S1, S2, S10
Leucanthemum vulgare	oxeye daisy	H2, H3, H4, H5, M1, M4, S1, S2, S3, S6, S8, S10, S16, S21, S23, S24, S30, S35, W8, W12
Matricaria discoidea	pineappleweed	H3, M1, M3, M4, S1, S3, S5, S8, S10
Picris echioides	bristly oxtongue	S27, S35, W9, W12, W13
Picris hieracioides	hawkweed oxtongue	S35
Pilosella aurantiaca	fox-and-cubs	M4, S30
Pulicaria dysenterica	common fleabane	W4
Senecio jacobaea	common ragwort	H2, M4, S1, S2, S3, S35, W8, W12, W13
Senecio vulgaris	groundsel	M3, S6, S16
Solidago canadensis	Canadian goldenrod	S23
Sonchus arvensis	perennial sow-thistle	M1
Sonchus oleraceus	smooth sow-thistle	S1, S5, S35
Tanacetum parthenium	feverfew	H3
Tanacetum vulgare	tansy	M1
Taraxacum officinale agg.	dandelion	H2, H3, H5, M1, M4, M5, S1, S2, S5, S7, S14, S16, S21, S24, S30, S35, W1, W4
Taraxacum pectinatiforme	dandelion	S16
Tripleurospermum inodorum	scentless mayweed	S23, S35, W8
Tussilago farfara	coltsfoot	H2, M1, S16, S23, W4

BERBERIDACEAE

Berberis gagnepainii	Gagnepain's barberry	P5
Mahonia aquifolium	Oregon-grape	P3

BETULACEAE

Alnus glutinosa	alder	M4, S23, S24
Betula pendula	silver birch	S3, S5, S6, S7, S14, S15
Carpinus betulus	hornbeam	H1, H4, S21
Corylus avellana	hazel	H1, H2, H4, H5, M1, S2, S3, S5, S7, S8, S24

BORAGINACEAE

Echium vulgare	viper's-bugloss	H3, M1, S11
Myosotis scorpioides	water forget-me-not	W8, W10, W11, W12, W13
Pentaglottis sempervirens	green alkanet	H3, S18
Symphytum officinale	common comfrey	H2, W4

BRASSICACEAE

Alliaria petiolata	garlic mustard	H2, H4, H5, S21
Arabidopsis thaliana	thale cress	M3
Capsella bursa-pastoris	shepherd's purse	M3, S9
Cardamine flexuosa	wavy bitter cress	S6, W4
Cardamine pratensis	cuckoo flower	M4
Coronopus didymus	lesser swine cress	M1, M3
Hesperis matronalis	dame's violet	S16
Hirschfeldia incana	hoary mustard	H2, H3, S5, S12
Raphanus raphanistrum	wild radish	S16
Sinapis arvensis	charlock	S35
Sisymbrium officinale	hedge mustard	M3, S2

BUDDLEJACEAE

Buddleja davidii	butterfly bush	M1, S1, S16, S27, S30

BUTOMACEAE

Butomus umbellatus	flowering rush	W10, W13

BUXACEAE

Buxus sempervirens	box	P5

CAMPANULACEAE

Campanula rotundifola	harebell	M4, S11, S30, W9
Campanula trachelium	nettle-leaved bellflower	H2, S21

CAPRIFOLIACEAE

Leycesteria formosa	Himalayan honeysuckle	S16
Lonicera periclymenum	honeysuckle	H2, H4, S3, S5, S6, S16
Sambucus nigra	alder	M4, S3, S5
Symphoricarpos albus	snowberry	P3
Viburnum opulus	guelder rose	S15, S27

CARYOPHYLLACEAE

Cerastium fontanum ssp.	common mouse-ear	S35
Lychnis flos-cuculi	ragged robin	M4, S35, W8, W13
Silene latifolia	white campion	S8
Silene dioica	red campion	H1, H2, H3, H4, H5, S2, S3, S5, S7, S8, S10, S16, S21, S23, S30
Silene vulgaris	bladder campion	M4, M5, W8
Stellaria graminea	lesser stitchwort	S16
Stellaria holostea	greater stitchwort	P1, S19, S21
Stellaria media	common chickweed	H5, S6, S14

CELASTRACEAE

Euonymus europaeus	spindle	M1, M4, M5, S30
Euonymus japonicus	evergreen spindle	P5

CERATOPHYLLACEAE

Ceratophyllum demersum	rigid hornwort	W15

CHENOPODIACEAE

Atriplex patula	common orache	H5, S5
Atriplex prostrata	spear-leaved orache	S16
Chenopodium album	fat hen	S8, S10, S21
Chenopodium hybridum	maple-leaved goosefoot	S6
Chenopodium polyspermum	many-seeded goosefoot	S5

CISTACEAE

Helianthemum nummularium	common rock-rose	M1

CLUSIACEAE

Hypericum hirsutum	hairy St John's-wort	S5, S8
Hypericum perforatum	perforate St John's-wort	M1, S2, S7, W4
Hypericum tetrapterum	square-stalked St John's-wort	S35

CONVOLVULACEAE

Calystegia sepium	hedge bindweed	H5, S1, S2, S6, S7, S8, S16, W13
Calystegia silvatica	large bindweed	H2, H4, W9
Convolvulus arvensis	field bindweed	M3, S3, S14, W8, W13

CORNACEAE

Aucuba japonica	spotted laurel	P5
Cornus sanguinea	dogweed	S3, S23, W8, W12

CUPRESSACEAE

Juniperus communis	common juniper	M1, S1

CYPERACEAE

Carex acutiformis	lesser pond-sedge	W8
Carex divulsa	grey sedge	W9
Carex elata	tufted sedge	W13, W4
Carex flacca	glaucous sedge	M1
Carex pendula	pendulous sedge	S5, W4
Carex riparia	greater pond-sedge	W8, W13
Carex sylvatica	wood-sedge	S18
Cladium mariscus	great fen-sedge	W4
Cyperus longus	galingale	W8, W13
Eleogiton fluitans	floating club-rush	W15
Scirpus lacustris	common club-rush	W15

DENNSTAEDTIACEAE

Pteridium aquilinum	bracken	S5

DIPSACACEAE

Dipsacus fullonum	wild teasel	H2, H3, H5, M1, M4, M5, S1, S2, S3, S5, S6, S8, S10, S11, S21, S23, S24, S30, S35, W1, W8, W9, W12, W13
Knautia arvensis	field scabious	M1, S1, S21, S35
Scabiosa columbaria	small scabious	H3, M1, M4, S2, S23, S30

DRYOPTERIDACEAE

Dryopteris dilatata	broad buckler fern	S18
Dryopteris filix-mas	male fern	M1, S16

EQUISETACEAE

Equisetum arvense	field horsetail	S18, W4
Equisetum fluviatile	water horsetail	W9

ERICACEAE

Calluna vulgaris	heather	S14, S15
Erica cinerea	bell heather	S14, S15

EUPHORBIACEAE

Euphorbia helioscopia	sun spurge	M3
Euphorbia peplus	petty spurge	H1, H3, S5, S6, S14
Mercurialis annua	annual mercury	S5
Mercurialis perennis	dog's mercury	S2, S19, S21

FABACEAE

Anthyllis vulneraria	kidney vetch	M1
Cytisus scoparius	broom	S2, S14
Laburnum anagyroides	laburnum	P5
Lathyrus pratensis	meadow vetchling	S2, S35
Lotus corniculatus	common bird's-foot trefoil	M1, M4, M5, S1, S35, W13
Lotus pedunculatus	greater bird's-foot trefoil	S2, W1, W4, W12
Medicago lupulina	black medick	H3, M1, M4, S1, S2, S6, W9, W12
Ononis repens	common restharrow	S13
Trifolium dubium	lesser trefoil	H2, S35
Trifolium pratense	red clover	M1, S1, S35
Trifolium repens	white clover	H4, M1, M4, S2, S24, S30, S35, W12
Ulex europaeus	gorse	S14, S15
Ulex gallii	western gorse	S14, S15
Ulex minor	dwarf gorse	S14, S15
Vicia cracca	tufted vetch	W4
Vicia sativa	comon vetch	H2, H3, H4, M1, M4, S11, S24, S35

FAGACEAE

Fagus sylvatica	beech	S2
Quercus ilex	evergreen oak	P1
Quercus petraea	sessile oak	S5, S7
Quercus robur	pedunculate oak	H1, H2, H5, S3, S5, S6, S7, S8, S21

GENTIANACEAE

Blackstonia perfoliata	yellow-wort	M1

GERANIACEAE

Geranium dissectum	cut-leaved cranesbill	H4
Geranium pratense	meadow cranesbill	S11, S35
Geranium pyrenaicum	hedgerow cranesbill	H2, S23, S24
Geranium robertianum	herb Robert	H4, H5, S3, S16, S21, W4
Geranium sylvaticum	wood cranesbill	S16

HALORAGACEAE

Myriophyllum spicatum	spiked water-milfoil	W14

HIPPOCASTANACEAE

Aesculus hippocastanum	horse chestnut	S27

HIPPURIDACEAE

Hippuris vulgaris	mare's-tail	W13

HYDRANGEACEAE

Philadelphus coronarius	mock-orange	P1, P5

HYDROCHARITACEAE

Hydrocharis morsus-ranae	frogbit	W15

IRIDACEAE

Iris pseudacorus	yellow iris	W4, W8, W9, W10, W11, W12, W13

ISOETACEAE

Isoetes lacustris	quillwort	W16

JUNCACEAE

Juncus effusus	soft rush	W4, W9
Juncus inflexus	hard rush	W9

LAMIACEAE

Ajuga reptans	bugle	S3, S6
Ballota nigra	black horehound	H5, M3, S1, S3, S5, S10, S11, S14, S15, S24, S28, W1, W9
Clinopodium vulgare	wild basil	M1
Glechoma hederacea	ground ivy	H4, M3, S1, S5, S8, S21, S27
Lamiastrum galeobdolon	yellow archangel	H5, S6, S10
Lamium album	white dead nettle	M1, S16
Lamium purpureum	red dead nettle	S2
Lycopus europaeus	gipsywort	W4, W8, W11, W12
Mentha aquatica	water mint	W4, W8, W11, W12
Origanum vulgare	wild majoram	M1, M3, S1, S2
Prunella vulgaris	selfheal	H2, H3, M1, M4, M5, S1, S2, S3, S6, S11, S14, S21, S23, S30, S35, W1, W9, W12, W13
Salvia verbenaca	wild clary	M4, S35
Stachys officinalis	betony	S8, S11, S30, S35
Stachys sylvatica	hedge woundwort	S1, S2, S10
Teucrium scorodonia	wood sage	S6, S7
Thymus polytrichus	wild thyme	M1, S28

LEMNACEAE

Lemna minor	common duckweed	W15, W16

LILIACEAE

Allium ursinum	ramsons	H2, S2, S3, S19
Hyacinthoides hispanica	Spanish bluebell	P1
Hyacinthoides non-scripta	bluebell	S3, S6
Narcissus pseudonarcissus	daffodil	S10

LYTHRACEAE

Lythrum salicaria	purple loosestrife	S23, W4, W8, W9, W11, W12, W13

MALVACEAE

Malva moschata	musk-mallow	M4, S35
Malva neglecta	dwarf mallow	S1
Malva sylvestris	common mallow	H2, M1, M3, M4, M5, S2, S11, S35, W1, W9, W12

MENYANTHACEAE

Menyanthes trifoliata	bogbean	W8, W9, W12

NYMPHAEACEAE

Nymphaea alba	white water-lily	W15

OLEACEAE

Fraxinus excelsior	ash	S1, S2, S5, S7
Ligustrum lucidum	shiny privet	P1
Ligustrum ovalifolium	garden privet	P1, P3, P5
Ligustrum vulgare	wild privet	M1
Syringa vulgaris	lilac	P1, P3

ONAGRACEAE

Chamerion angustifolium	rosebay willowherb	H3, H4, H5, M1, S8, S21
Circaea lutetiana	enchanter's nightshade	H5, S2, S3, S7, S24
Epilobium hirsutum	great willowherb	H5, S2, S3, S7, S8, S16, S28, S30, W4, W8, W9, W10, W11, W12, W13
Epilobium parviflorum	hoary willowherb	S16
Epilobium roseum	pale willowherb	S5, S14, S16, S24, S28, S30
Epilobium tetragonum	square-stalked willowherb	S16
Oenothera biennis	common evening primrose	S6

PINACEAE

Pinus sylvestris	Scots pine	S14, S15

PLANTAGINACEAE

Plantago lanceolata	ribwort plantain	H2, H3, H4, H5, M1, M3, M4, M5, S1, S2, S5, S6, S7, S8, S10, S11, S14, S23, S27, S30, S35, W1, W4, W8, W9, W10, W12, W13
Plantago major	greater plantain	M1, M4, S3, S5, S6, S7, S14, S24, S30, S35

PLATANACEAE

Platanus × *hispanica*	London plane	P1, P5, S4, S5, S15, S20, S21

POACEAE

Agrostis capillaris	common bent	H2, H3, M1, M4, M5, S1, S2, S5, S8, S10, S11, S16, S23, S24, S30, S35, W1, W13
Agrostis curtisii	bristle bent	S14
Agrostis stolonifera	creeping bent	M1, M3, M4, P5, S2, S5, S7, S8, S16, S21, S27, S35, W11, W12, W13
Anthoxanum odoratum	sweet vernal grass	M4, S2, S35
Arrhenatherum elatius	false oat grass	M1, S10, S11
Brachypodium sylvaticum	false brome	H2, H4, S1, S2, S10, S16
Briza media	quaking grass	M1, M4, S30, S35
Bromopsis erecta	upright brome	M1
Bromus diandrus	great brome	H2
Bromus hordaceus	soft brome	S11, S30
Bromus sterilis	barren brome	S27, S35
Cynosurus cristatus	crested dog's-tail	H4, M1, M4, S30, S35, W1, W8, W13
Dactylis glomerata	cocksfoot	H2, M1, M3, M4, M5, S1, S10, S21, S23, S27, W1
Deschampsia cespitosa	tufted hair-grass	H4, M4, M5, S16, S21, S30, W4, W8, W13
Deschampsia flexuosa	wavy hair-grass	W1
Elymus repens	common couch	M4, S1, S10, S11, W9, W13
Festuca ovina	sheep's fescue	M1, DF

Festuca rubra	red fescue	H2, H4, M1, M3, M4, M5, S1, S2, S24, S30, W1, W8, W13
Glyceria maxima	reed sweet-grass	W8, W12
Helictotrichon pratense	meadow oat-grass	M1
Holcus lanatus	Yorkshire fog	H1, H2, H3, H4, H5, M1, M3, M4, S5, S6, S7, S8, S10, S14, S16, S21, S23, S24, S28, S35, W1, W4, W8, W11, W13
Holcus mollis	creeping soft-grass	S2
Lolium perenne	perennial rye-grass	H3, M1, M4, M5, S11, S14, S28, S30, S35, W9, W13
Melica uniflora	wood mellick	P1, S16, S18
Molinia caerulea	purple moor-grass	S14
Phleum bertolonii	smaller cat's-tail	M1
Phleum pratense	timothy	M3, M4, S27
Phragmites australis	common reed	W4, W5, W6, W7, W8, W13
Poa annua	annual meadow-grass	S5, S23, S35
Poa nemoralis	wood meadow-grass	S21
Poa trivialis	rough meadow-grass	H5, S35, W12
Trisetum flavescens	yellow cat-grass	M4

POLEMONIACEAE

Polemonium caeruleum	Jacob's ladder	S30

POLYGONACEAE

Persicaria maculosa	redshank	S3, S5, S6, S24
Polygonum aviculare	knotgrass	S5, S14, S28
Rumex acetosa	comon sorrel	S1, S8
Rumex hydrolapathum	water dock	W8
Rumex obtusifolius	broad-leaved dock	H4, H5, M1, M4, M5, S2, S7, S23, S24, S28, W4, W12, W13
Rumex patientia	patience dock	S35

POTAMOGETONACEAE

Potamogeton crispus	curled pondweed	W14, W16

PRIMULACEAE

Hottonia palustris	water violet	W15
Lysimachia nummularia	creeping jenny	H3, W4, W9
Lysimachia vulgaris	yellow loosestrife	W4, W8, W13
Primula elatior	oxlip	S16
Primula veris	cowslip	M1, M4, S8, S16, S35
Primula vulgaris	primrose	H2, H4, H5

RANUNCULACEAE

Anemone nemorosa	wood anemone	S5, S7
Aquilegia vulgaris	columbine	S5, S6, S7
Caltha palustris	marsh marigold	W4, W8, W12, W13
Clematis vitalba	traveller's joy	H1, H2, H4, M1, M3, S1, S2, S8, S16, S27
Ranunculus acris	meadow buttercup	M5, S3, S7, S30, S35, W8, W9, W11, W12, W13
Ranunculus bulbosus	bulbous buttercup	H2, M4, M5
Ranunculus ficaria	lesser celandine	S5, S20, S21
Ranunculus lingua	greater spearwort	W8, W11
Ranunculus repens	creeping buttercup	H2, H3, H4, H5, M1, M3, M4, M5, S1, S2, S7, S8, S16, S21, S24, S27, W1, W4, W9, W12, W13
Thalictrum flavum	common meadow rue	S30, W4

RESEDACEAE

Reseda lutea	wild mignonette	M1

ROSACEAE

Crataegus laevigata	Midland hawthorn	P5
Crataegus monogyna	hawthorn	H2, H3, H4, H5, M5, S8, S21, S30
Filipendula ulmaria	meadowsweet	M4, M5, S24, W4, W8, W9, W11, W12
Fragaria vesca	wild strawberry	H2, S5, S30
Geum urbanum	wood avens	H1, H2, H3, M4, M5, S3, S11, S23
Malus sp.	apple seedling	H2, S8
Malus sylvestris	crab apple	H2, H3, H6, S16
Potentilla anserina	silverweed	S35
Potentilla reptans	creeping cinquefoil	H3, M3, M4, M5, S1, S2, S3, S6, S7, S8, S14, S15, W1, W4, W13
Prunus avium	wild cherry	S3, S5, P1, M3, S18
Prunus padus	bird cherry	S3, S5
Prunus spinosa	blackthorn	W8
Prunus spp.	cherry seedlings	P3, P4, P5, S3, S5
Rosa canina	dog rose	H2, H5, S10
Rubus fruticosus agg.	bramble	H3, H4, M1, S2, S3, S16, S24, W1
Sanguisorba minor ssp. *minor*	salad burnet	M1, M3, S1
Sanguisorba officinalis	great burnet	M4
Sorbus aria	common whitebeam	S13, S31
Sorbus aucuparia	rowan	H5, M5, S6, S10, S24, S30

RUBIACEAE

Galium aparine	goosegrass	H2, H4, H5, S2, S28
Galium mollugo	hedge bedstraw	H2, H4, M1, M3, M4, M5, S1, S2, S3, S5, S6, S7, S8, S10, S21, S30, W1, W8, W9, W11, W12, W13
Galium odoratum	woodruff	S5, S6
Galium verum	lady's bedstraw	M1, S1, S2
Sherardia arvensis	field madder	M1

SALICACEAE

Populus cv	'Lombardy poplar'	S35
Salix alba × *S. fragilis*		S11
Salix aurita	eared willow	S28
Salix caprea	goat willow	P1, S5, S12, S28, W1
Salix cinerea	grey willow	S28, S31, W1

SCROPHULARIACEAE

Digitalis purpurea	foxglove	H2, H3, H5, S3, S5, S6, S8, S14, S16, S21, S23, S24, S28
Linaria vulgaris	common toadflax	H3, M4, S2, S11, S12, S28, S30
Scrophularia auriculata	water figwort	M1, S2, S30, W8, W9, W12, W13
Scrophularia nodosa	common figwort	W4
Verbascum thapsus	great mullein	S1, S2
Veronica beccabunga	brooklime	S28, W8, W11, W13
Veronica serpyllifolia	thyme-leaved speedwell	S35

SOLANACEAE

Solanum dulcamara	bittersweet	S5, S8, W8
Solanum nigrum	black nightshade	S3, S21, S23

	SPARGANIACEAE	
Sparganium erectum	branched bur-reed	W13
	TAXACEAE	
Taxus baccata	yew	S2, S3
	THELYPTERIDACEAE	
Thelypteris palustris	marsh fern	W4
	TILIACEAE	
Tilia cordata	small-leaved lime	S8
	URTICACEAE	
Urtica dioica	common nettle	H1, H4, H5, M1, M3, M5, S1, S2, S5, S6, S8, S11, S14, S16, S21, S30, W1, W4, W9, W10, W12, W13
Urtica galeopsifolia	fen nettle	W4
Urtica urens	small nettle	S8
	VIOLACEAE	
Viola arvensis	field pansy	S16
Viola riviniana	common dog-violet	H2, S23
	WOODSIACEAE	
Athyrium filix-femina	lady fern	S18

APPENDIX 2

Specialist growers and suppliers who claim to supply British native plants and seeds and who can provide information on the native origin of their stock.

Alaska Environmental Contracting
Stokeford Farm, East Stoke, Wareham, Dorset BH20 6AL
Tel: 01929 463301 Fax: 01929 463889

Alba Trees plc
Lower Winton, Gladsmuir, East Lothian EH33 2AL
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Tel: 01603 716615 Fax: 01603 716615

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Forestart
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Glantless Trees and Hedging
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High Value Horticulture
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Tel: 01747 811778 Fax: 01747 811499

John Shipton Bulbs
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Tel: 01994 240125 Fax: 01994 241180

Kingsdown Nurseries
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Tel: 01793 705290

Landlife
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Merton Hall Pond Ltd
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Tel: 01565 722995

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Tel: 01926 496656

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Tel: 01452 311525

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The flora of Barnes Common

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Summary

This paper reviews previous accounts by botanists of the flora of Barnes Common from the sixteenth century to the present day, noting that this is generally treated as part of the flora of Surrey and London and rarely as a separate entity. A list is presented of all species recorded on the Common from 1989 to 1999. Changes in the flora over the last hundred years are discussed pointing out notably the increased number of garden escapes and casual aliens.

Introduction

Barnes Common is well known to naturalists today, and also to the general public as a pleasant place for walking and recreation. Its history is in general terms well known too, and plenty has been written about its development from common ground through the Middle Ages to its situation today — 96 hectares (230 acres) or so of pleasant, open ground surrounded by houses and crossed by several big roads and also by the railway. Its physical character is no less familiar — a flat sandy area, dry and drier than it used to be, supporting the trees and vegetation that one might expect of it and reminiscent of the Surrey heathlands further south of which it may well be regarded as an outlier.

Botanists know it well and visit it frequently, but it has attracted relatively little interest as a separate entity from a botanical point of view. Writers of botanical works, from the sixteenth century to the present day, have mostly treated it as part of Surrey, or of London as the case may be. Most of them evidently found the flora of Surrey interesting and made records from there. Turner (1508–1568) did, as did Gerarde, Ray and Evelyn in the seventeenth century, to name but a few. The first substantial Surrey list was by Christopher Merrett (1666) in his *Pinax Rerum Naturalium Britannicarum* and it is particularly interesting to find that he noted *Rosa pimpinellifolia* (*spinosissima*) growing on Barnes Common. The flora of Surrey continued to hold a significant place in many works published in the eighteenth century, but it was in nineteenth-century books about the flora of London that Barnes Common first appears as an entity in its own right. Daniel Cooper published, in 1836, his *Flora Metropolitana: or, Botanical rambles within thirty miles of London,* which included separate plant lists for a number of localities, of which Barnes Common was one. This treatment by localities was followed by de Crespigny (1876) in his *New London flora*. His list of about sixty species from there does not aim to be a full account, but consists, evidently, of plants which for one reason or another caught his interest; for instance, *Anthemis nobilis, Salix repens* and *Teesdalia nudicaulis*. Finally, the naturalist F. A. Paley (1882) published in the *West London Observer* a list of nearly 200 flowering plants found on Barnes Common, a selective list still, but of great interest. His list and that of de Crespigny, incomplete though they are, remain a basis for later comparison and evaluation of the changes in habitat, both these authors having been interested in what one might term the 'native' plants of the Common, i.e., plants of dry heathland and, in Paley's case, water-loving plants as well.

In recent times the Common's flora has continued to be treated as part of the flora of wider areas. For Surrey, Salmon (1931) and Lousley (1976) refer to it and include records from it in their floras, while for London, Kent and Lousley (1951–1957) adopt the same approach in their *Handlist of the plants of the London Area*; so does Burton (1983) in his *Flora of the London Area.* A brief study by Mrs Margaret Whitehouse (1952) appeared in *The London Naturalist,* but no full list of plants recorded from Barnes Common has been published.

The flora

In drawing up the present list the aim has been to make a full and up-to-date record of all the species growing on the Common (except those in gardens), a checking point, as it were, at the end of the twentieth century in its floristic development. Records have been compiled over about ten years and more intensively over 1997–1999, earlier records also being checked during this time. Mr Alan Newton has kindly provided a list of brambles which he identified on the Common in 1991. The area surveyed is shown on the accompanying map (Figure 1). Indications of habitat and status are given, but no attempt has been made to separate native from introduced species.

Both Latin and English names are those of Stace's *New flora of the British Isles,* second edition 1997.

The resulting list is presented in alphabetic order for ease of reference.

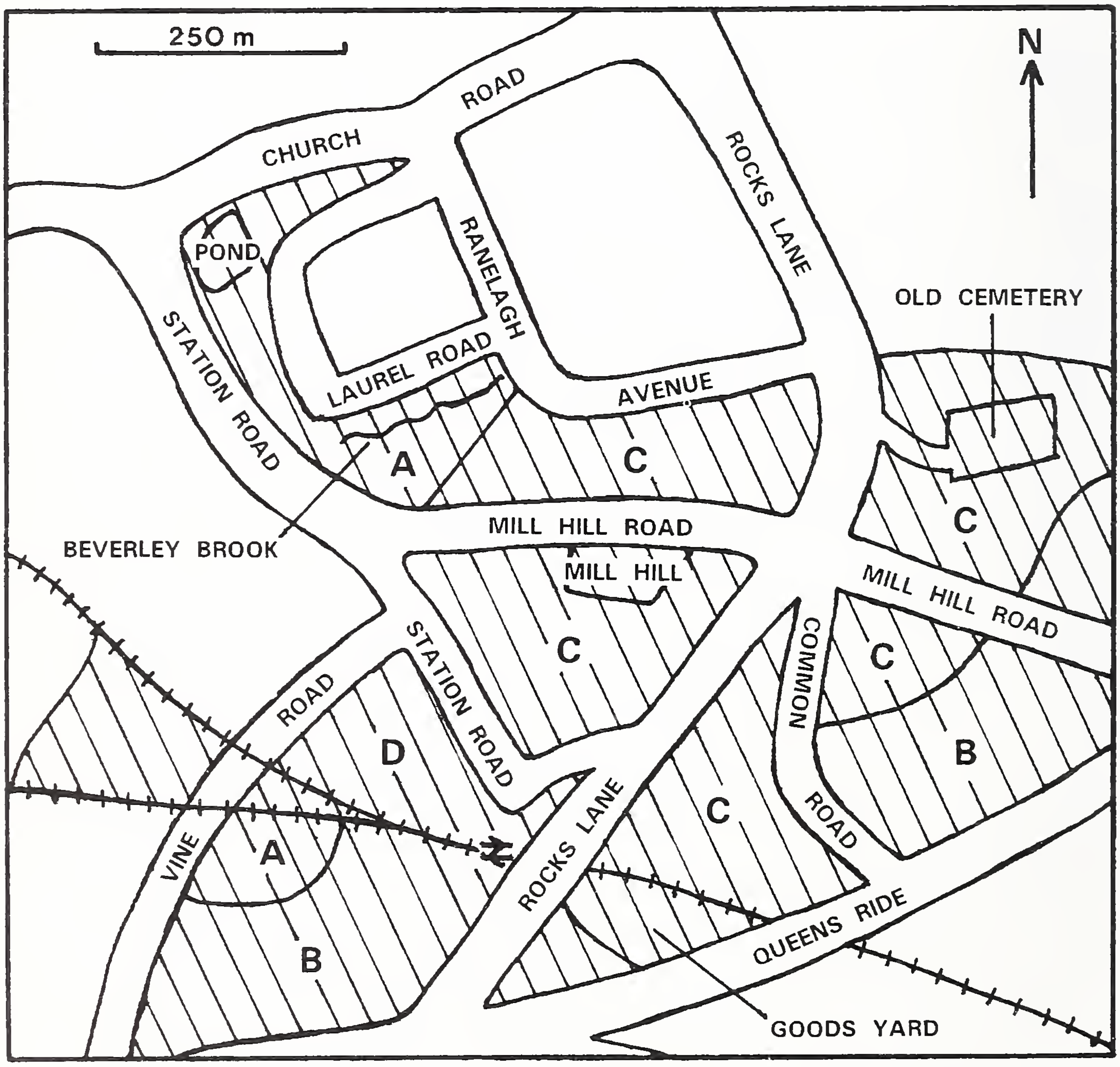

FIGURE 1. Barnes Common showing area surveyed hatched.
A – damp meadow; B – woodland; C – heathland; D – meadow.

Acer campestre field maple: uncommon, ? planted.
Acer platanoides Norway maple: uncommon, seedlings in woodland.
Acer pseudoplatanus sycamore: planted and self-seeding.
Achillea millefolium yarrow: common.
Aegopodium podagraria ground elder: common.
Aesculus carnea red horse-chestnut: planted near cemetery.
Aesculus hippocastanum horse-chestnut: planted and self seeding, common.
Agrostis capillaris common bent: common.
Agrostis stolonifera creeping bent: common.
Ailanthus altissima tree of heaven: one young tree.
Aira praecox early hair-grass: common in sandy places.
Alliaria petiolata garlic mustard: common.
Allium triquetrum three-cornered garlic: frequent near houses.
Allium vineale wild onion: uncommon.
Alnus cordata Italian alder: planted near pond.
Alnus glutinosa alder: planted near pond.
Alnus incana grey alder: planted near pond.
Alopecurus geniculatus marsh foxtail: rare, damp meadow.
Alopecurus pratensis meadow foxtail: common.
Amaranthus retroflexus common amaranth: casual.
Amelanchier lamarckii juneberry: rare, one tree, woodland.
Angelica archangelica garden angelica: planted by pond.
Anisantha sterilis barren brome: common.
Anthoxanthum odoratum sweet vernal-grass: uncommon.
Anthriscus sylvestris cow parsley: common.
Antirrhinum majus snapdragon: rare, goods yard.
Aphanes australis slender parsley-piert: frequent in sandy areas.
Apium nodiflorum fool's watercress: in Beverley Brook.
Arabidopsis thaliana thale cress: frequent.
Arctium minus ssp. *minus* lesser burdock: frequent.
Arctium minus ssp. *pubens*: occasional.
Arctium nemorosum wood burdock: occasional.
Arenaria serpyllifolia thyme-leaved sandwort: frequent.
Armoracia rusticana horseradish: common.
Arrhenatherum elatius false-oat grass: common.
Artemisia verlotiorum Chinese mugwort: rare, one large patch.
Artemisia vulgaris mugwort: common.
Arum italicum ssp. *italicum* Italian lords and ladies: garden escape.
Arum maculatum lords and ladies: frequent.
Asparagus officinalis ssp. *officinalis* garden asparagus: occasional.
Aster novi-belgii confused Michaelmas daisy: common.
Aster versicolor late Michaelmas daisy: rare, one patch.
Aster × *salignus* common Michaelmas daisy: common.
Atriplex patula common orache: casual.
Atriplex prostrata spear-leaved orache: casual.
Ballota nigra black horehound: common.
Barbarea vulgaris winter-cress: casual, goods yard.
Bellis perennis daisy: frequent.
Betula pendula silver birch: common.
Betula pubescens ssp. *pubescens* downy birch: rare.
Betula pendula × *pubescens* = *Betula* × *aurata*: frequent.
Brassica napus rape: casual.
Brassica rapa turnip: casual.
Brassica nigra black mustard: casual.
Bromus hordeaceus ssp. *hordeaceus* soft brome: common.
Bryonia dioica white bryony: occasional, hedgerows.
Buddleja davidii butterfly bush: frequent.
Butomus umbellatus flowering-rush: planted by pond.
Calluna vulgaris ling: rare, heathland.
Calystegia × *lucana* (*C. sepium* × *C. silvatica*): common.
Calystegia silvatica large bindweed: uncommon, near Beverley Brook.
Campanula rapunculoides creeping bellflower: garden outcast.

Campanula rotundifolia harebell: rare.

Campanula trachelium nettle-leaved bellflower: rare.

Capsella bursa-pastoris shepherd's purse: common.

Cardamine flexuosa wavy bitter-cress: occasional.

Cardamine hirsuta hairy bitter-cress: common.

Cardamine pratensis lady's smock: occasional.

Carex glauca glaucous sedge: planted by pond.

Carex hirta hairy sedge: uncommon, damp meadow.

Carex ovalis oval sedge: occasional.

Carex pendula pendulous sedge: planted by pond.

Carex remota remote sedge: rare, one plant in woodland.

Castanea sativa sweet chestnut: saplings in woodland.

Cedrus atlantica Atlas cedar: planted in cemetery.

Cedrus deodara deodar cedar: planted in cemetery.

Cedrus libani cedar of Lebanon: planted in cemetery.

Centaurea nigra common knapweed: uncommon, rough grassland.

Cerastium fontanum common mouse-ear: common.

Cerastium glomeratum sticky mouse-ear: frequent.

Cerastium tomentosum snow-in-summer: established, one large patch.

Ceratochloa carinata Californian brome: abundant and spreading.

Chamaecyparis lawsoniana Lawson's cypress: planted in cemetery, seedlings.

Chaenorhinum minus small toadflax: rare, goods yard.

Chamerion angustifolium rosebay willowherb: frequent.

Chelidonium majus greater celandine: frequent near houses, also a double form.

Chenopodium album fat hen: casual.

Chenopodium rubrum red goosefoot: casual.

Chrysanthemum segetum corn marigold: casual, by pond.

Circaea lutetiana enchanter's nightshade: frequent.

Cirsium arvense creeping thistle, common.

Cirsium vulgare spear thistle: frequent.

Claytonia perfoliata spring beauty: waste ground.

Conium maculatum hemlock: common.

Convolvulus arvensis field bindweed: occasional, goods yard.

Conyza canadensis Canadian fleabane: common established alien.

Conyza sumatrensis Guernsey fleabane: increasing.

Corydalis solida bird-in-a-bush: garden escape.

Corylus avellana hazel: occasional.

Cotoneaster conspicuus Tibetan cotoneaster.

Cotoneaster dielsianus Diels' cotoneaster.

Cotoneaster franchetii Franchet's cotoneaster.

Cotoneaster horizontalis wall cotoneaster.

Cotoneaster lacteus late cotoneaster.

Cotoneaster simonsii Himalayan cotoneaster.

Cotoneaster × *watereri* Waterer's cotoneaster.

All the above species of cotoneaster are self-sown or bird-sown in cemetery.

Cotoneaster frigidus tree cotoneaster: woodland, Queens Ride.

Cotoneaser helmqvistii Helmqvist's cotoneaster: self-sown outside houses, Mill Hill.

Crataegus monogyna hawthorn: common.

Crataegus × *media* (*C. monogyna* × *C. laevigata*): one bush, woodland.

Crepis capillaris smooth hawk's-beard: common.

Crepis vesicaria beaked hawk's-beard: frequent.

Crocus tommasinianus early crocus: occasional garden escape.

Crocus vernus spring crocus: garden outcast, Mill Hill.

Cymbalaria muralis ivy-leaved toadflax: rare, station brickwork.

Cynosurus cristatus crested dog's-tail: frequent.

Cytisus multiflorus white broom: rare, one bush.

Cytisus scoparius broom: common.

Cytisus scoparius var. *andreanus*: frequent.

Dactylis glomerata cocksfoot: common.

Deschampsia cespitosa tufted hair-grass: uncommon.

Deschampsia flexuosa wavy hair-grass: abundant.

Digitalis purpurea foxglove: occasional.

Digitaria sanguinalis hairy finger-grass: rare, established by railway.
Diplotaxis tenuifolia perennial wall-rocket: uncommon.
Dryopteris dilatata broad buckler-fern: rare, woodland.
Dryopteris filix-mas male fern: uncommon.
Elodea nuttallii Nuttall's waterweed: in Beverley Brook.
Elytrigia repens ssp. *repens* common couch: common.
Epilobium ciliatum American willowherb: common.
Epilobium hirsutum great willowherb: by Beverley Brook.
Epilobium montanum broad-leaved willowherb: common.
Epilobium tetragonum square-stalked willowherb: frequent.
Epilobium ciliatum × *montanum*: occasional, in cemetery.
Equisetum arvense field horsetail: occasional, waste ground.
Eranthis hyemalis winter aconite: garden outcast, Mill Hill.
Erodium cicutarium common stork's-bill: rare, sandy areas.
Euonymus japonicus evergreen spindle: planted and self-seeding.
Euphorbia helioscopia sun spurge: occasional, waste ground.
Euphorbia lathyris caper spurge: garden escape, Mill Hill.
Euphorbia peplus petty spurge: occasional, disturbed ground.
Fallopia baldschuanica Russian vine: long established, roadside.
Fallopia convolvulus black bindweed: casual.
Fallopia japonica Japanese knotweed: several patches.
Fatsia japonica fatsia: three plants, bird-sown in woodland.
Festuca arundinacea tall fescue, uncommon.
Festuca filiformis fine-leaved sheep's fescue: uncommon.
Festuca ovina ssp. *ovina* sheep's fescue: common.
Festuca rubra ssp. *rubra* red fescue: common.
Ficus carica fig: recently planted in hedgerow.
Forsythia × *intermedia* forsythia: one old bush, planted in cemetery.
Fraxinus excelsior ash: infrequent, planted.
Fraxinus ornus manna ash: planted, one tree and sapling.
Fumaria officinalis common fumitory: casual.
Galanthus nivalis snowdrop: frequent near houses.
Galega officinalis goat's rue: common, goods yard.
Galinsoga parviflora gallant-soldier: occasional.
Galium aparine goosegrass: common.
Galium saxatile heath bedstraw: uncommon.
Galium verum lady's bedstraw: rare.
Genista hispanica Spanish gorse: planted, cemetery.
Geranium dissectum cut-leaved cranesbill: frequent in cemetery.
Geranium lucidum shining cranesbill: rare, one patch, roadside.
Geranium molle dove's-foot cranesbill: common.
Geranium pyrenaicum hedgerow cranesbill: common.
Geranium robertianum herb robert: frequent, a white variant at Mill Hill.
Geranium rotundifolium round-leaved cranesbill: common in cemetery.
Geum urbanum wood avens: occasional.
Glechoma hederacea ground ivy: uncommon, cemetery.
Glyceria fluitans floating sweet-grass: uncommon, damp meadow.
Hebe sp. hedge veronica: planted, cemetery.
Hebe rakaiensis: planted, cemetery.
Hedera helix ssp. *helix* common ivy: common.
Hedera helix ssp. *hibernica* Atlantic ivy: common.
Hedera helix 'Sagittifolia': occasional.
Helianthus × *laetiflorus* perennial sunflower: garden outcast, Mill Hill.
Heracleum sphondylium hogweed: common.
Hieracium diaphanum, sabaudum, salticola, trichocaulon and *umbellatum*. All these *Hieracia* have been found on the Common from time to time though they do not well stand the drought. Barnes Common is one of the well-known sites for *H. salticola*. *H. diaphanum* was known in the goods yard, but may not have persisted there.
Holcus lanatus Yorkshire fog: common.
Holcus mollis creeping soft-grass: common.
Hordeum murinum wall barley: common.
Humulus lupulus hop: occasional, hedgerows.

Hyacinthoides non-scripta bluebell: uncommon, woodland.
Hyacinthoides hispanica × *non-scripta* hybrid bluebell: common.
Hypericum × *inodorum* tall tutsan: planted, cemetery.
Hypericum perforatum common St John's-wort: frequent.
Hypochoeris radicata cat's-ear: common.
Ilex aquifolium holly: common.
Ilex plants, probably back-crosses of *I. aquifolium* and *I. altaclerensis*: frequent in woodland.
Impatiens glandulifera Indian balsam: by Beverley Brook.
Iris foetidissima stinking iris: garden escape.
Iris pseudacorus yellow iris: by Beverley Brook and planted by pond.
Juncus effusus soft rush: frequent.
Juncus inflexus hard rush: uncommon.
Juncus squarrosus heath rush: rare, a few plants remaining.
Laburnum anagyroides laburnum: self-sown, occasional.
Lactuca serriola prickly lettuce: frequent, wasteground.
Lactuca virosa great lettuce: rare.
Lamiastrum galeobdolon ssp. *argentatum* yellow archangel: frequent garden escape.
Lamium album white dead-nettle: common.
Lamium amplexicaule henbit dead-nettle: casual.
Lamium purpureum red dead-nettle: common.
Lapsana communis nipplewort: common.
Lathyrus latifolius broad-leaved everlasting pea: established, several places.
Laurus nobilis bay: planted in cemetery.
Leontodon saxatilis lesser hawkbit: common.
Lepidium draba hoary cress: infrequent but spreading.
Leucanthemum vulgare ox-eye daisy: plentiful, cemetery.
Ligustrum ovalifolium garden privet: common.
Linaria purpurea purple toadflax: self-seeding, common.
Linaria vulgaris common toadflax: uncommon, rough grassland.
Lolium perenne perennial rye-grass: common.
Lonicera japonica Japanese honeysuckle: occasional garden escape.
Lonicera nitida Wilson's honeysuckle: garden escape, near pond.
Lonicera periclymenum honeysuckle: rare, woodland.
Lotus corniculatus common bird's-foot-trefoil: rare, goods yard.
Lunaria annua honesty: frequent garden escape, also white variant.
Lupinus polyphyllus garden lupin: long established by railway.
Luzula campestris field wood-rush: uncommon, cemetery.
Lychnis coronaria rose campion: established on roadside.
Lycopersicon esculentum tomato: casual, by pond.
Lycopus europaeus gipsywort: by Beverley Brook.
Lysimachia nummularia creeping jenny: planted by pond.
Lythrum salicaria purple loosestrife: planted by pond.
Mahonia aquifolium Oregon grape: naturalized in cemetery.
Malus domestica apple: frequent self-seeded bushes.
Malva neglecta dwarf mallow: rare, by pond.
Malva sylvestris common mallow: common.
Matricaria discoidea pineappleweed: common.
Matricaria recutita scented mayweed: casual.
Medicago lupulina black medick: frequent.
Medicago sativa ssp. *falcata* sickle medick: rare, long-established.
Melilotus alba white melilot: occasional.
Melilotus officinalis ribbed melilot: common.
Melissa officinalis balm: garden outcast.
Mercurialis annua annual mercury: common.
Mimulus guttatus monkeyflower: planted by pond.
Molinia caerulea purple moor-grass: occasional.
Muscari armeniacum garden grape hyacinth: occasional near houses.
Myosotis arvensis field forget-me-not: occasional, cemetery.
Myosotis sylvatica garden forget-me-not: occasional garden outcast.
Narcissus spp. daffodils: garden outcasts, frequent.
Narcissus 'Tête-à-Tête': rare outcast.
Nectaroscordum siculum ssp. *bulgaricum* honey garlic: established garden escape, Mill Hill.

Odontites vernus ssp. *serotinus* red bartsia: rare, goods yard.
Oenanthe crocata hemlock water-dropwort: uncommon, damp places.
Oenothera glazioviana large-flowered evening primrose: frequent.
Ornithogalum angustifolium star of Bethlehem: frequent near houses.
Ornithopus perpusillus bird's-foot: frequent, sandy areas.
Oxalis articulata pink sorrel: occasional near houses.
Oxalis corniculata procumbent yellow sorrel: occasional, railway line.
Papaver rhoeas common poppy: casual.
Parietaria judaica pellitory-of-the-wall: uncommon.
Parthenocissus quinquefolia Virginia creeper: naturalized, roadside.
Pentaglottis sempervirens green alkanet: common garden escape.
Persicaria amphibia amphibious bistort: plentiful, damp meadow.
Persicaria hydropiper water-pepper: by Beverley Brook.
Persicaria maculosa redshank: frequent.
Phalaris arundinacea reed canary-grass: planted by pond.
Phleum bertolonii smaller cat's-tail: common.
Phleum pratense timothy: common.
Photinia davidiana stranvaesia: one bush, bird-sown, woodland.
Phragmites australis common reed: planted by pond.
Phyllitis scolopendrium hart's-tongue: rare, on walls.
Picris echioides bristly oxtongue: occasional.
Picris hieracioides hawkweed oxtongue: occasional.
Pilosella officinarum mouse-ear hawkweed: uncommon, sandy areas.
Pinus nigra ssp. *nigra* Austrian pine: planted.
Pinus wallichiana Bhutan pine: planted in cemetery, also a self-sown seedling.
Plantago coronopus buck's-horn plantain: frequent, sandy areas.
Plantago lanceolata ribwort plantain: frequent.
Plantago major greater plantain: common.
Platanus × *hispanica* London plane: planted, some self-sown seedlings.
Poa annua annual meadow-grass: common.
Poa nemoralis wood meadow-grass: frequent.
Poa pratensis smooth meadow-grass: common.
Poa trivialis rough meadow-grass: common.
Polygonum arenastrum equal-leaved knotgrass: frequent on paths.
Polygonum aviculare knotgrass: common.
Populus × *canadensis* 'Serotina' black Italian poplar: planted.
Populus × *canadensis* 'Regenerata' railway poplar: planted.
Populus × *canescens* grey poplar: frequent.
Populus nigra ssp. *betulifolia* black poplar: one old tree still standing near station.
Populus nigra 'Italica' Lombardy poplar: planted and often suckering.
Populus nigra 'Plantierensis': planted.
Potentilla anserina silverweed: uncommon.
Potentilla reptans creeping cinquefoil: uncommon.
Prunella vulgaris self-heal: occasional, cemetery.
Prunus avium wild cherry: frequent.
Prunus cerasifera cherry plum: scattered in woodland.
Prunus cerasifera var. *pissardii*: woodland, Queens Ride
Prunus domestica ssp. *domestica* wild plum: hedgerows.
Prunus domestica ssp. *insititia* bullace: hedgerows.
Prunus laurocerasus cherry laurel: planted, seeding frequently.
Prunus serotina rum cherry: bird-sown, woodland.
Prunus spinosa blackthorn: common.
Prunus spinosa × *domestica* = *Prunus* × *fruticans*: frequent, thicket near cemetery.
Pseudofumaria lutea yellow corydalis: frequent.
Pteridium aquilinum bracken: abundant.
Pyracantha coccinea firethorn: bird-sown, cemetery.
Pyracantha rogersiana Asian firethorn: bird-sown, cemetery.
Pyrus communis pear: rare, self or bird-sown.
Quercus cerris Turkey oak: planted.
Quercus × *crenata* (*Q. cerris* × *Q. suber*): one tree, planted.
Quercus ilex evergreen oak: frequent, self-sown.
Quercus robur pedunculate oak: common.

Quercus rubra red oak: planted.
Ranunculus acris meadow buttercup: frequent.
Ranunculus bulbosus bulbous buttercup: uncommon.
Ranunculus ficaria ssp. *ficaria* lesser celandine: common.
Ranunculus ficaria ssp. *bulbilifer*: frequent.
Ranunculus ficaria ssp. *chrysocephalus*: garden escape, rare.
Ranunculus repens creeping buttercup: common.
Raphanus raphanistrum wild radish: casual.
Rapistrum rugosum bastard cabbage: casual.
Ribes sanguineum flowering currant: bird-sown, cemetery.
Robinia pseudoacacia false acacia: planted and self seeding, cemetery.
Rosa canina dog rose: common, in cemetery. (Groups *lutetianae* and *transitoriae* det. A.L. Primavesi).
Rosa 'Hollandica' Dutch rose: planted, cemetery.
Rosa pimpinellifolia burnet rose: rare, long-established.
Rosa sp.: white-flowered 'rambler': established on roadside for many years.
Rubus caesius dewberry: rare.
Rubus fruticosus agg. bramble: abundant. The following species were identified on the Common during 1991 by Mr Alan Newton: *R. armeniacus, armipotens, bakerianus, bartonii, cardiophyllus, cissburiensis, hylophilus, iodnephes, leightonii, platyacanthus, polyanthemus, rhombifolius* and *tuberculatus*.
Rubus idaeus raspberry: several stands.
Rumex acetosa common sorrel: uncommon, rough grassland.
Rumex acetosella sheep's sorrel: abundant, sandy areas.
Rumex conglomeratus clustered dock: occasional.
Rumex crispus curled dock: occasional.
Rumex obtusifolius broad-leaved dock: common.
Rumex patientia patience dock: rare.
Rumex pulcher fiddle dock: rare.
Sagina procumbens procumbent pearlwort: frequent.
Salix alba white willow: occasionally planted.
Salix × *calodendron* Holme willow: two large planted trees.
Salix caprea goat willow: frequent.
Salix cinerea ssp. *oleifolia* grey willow: frequent.
Salix fragilis var. *fragilis* crack willow: in woodland, ? planted.
Salix fragilis var. *furcata*: planted in woodland.
Salix fragilis var. *russelliana* Bedford willow: many planted trees.
Salix × *pendulina* weeping crack willow: one fine planted tree.
Salix × *rubens* (*S. alba* × *S. fragilis*) var. *basfordiana* hybrid crack willow: many planted trees.
Salix × *sepulcralis* 'Chrysocoma' weeping willow: several planted trees.
Salix repens creeping willow: rare.
Sambucus nigra elder: common.
Saponaria officinalis soapwort: uncommon: rough grassland.
Scrophularia nodosa common figwort: by Beverley Brook.
Sedum acre biting stonecrop: occasional.
Sedum rupestre reflexed stonecrop: spreading near Mill Hill.
Senecio jacobaea common ragwort: common.
Senecio squalidus Oxford ragwort: common.
Senecio sylvaticus heath groundsel: occasional.
Senecio vulgaris groundsel: common.
Silene dioica red campion: occasional, rough grassland.
Silene latifolia white campion: frequent.
Sinapis arvensis charlock: casual.
Sisymbrium officinale hedge mustard: common.
Solanum dulcamara bittersweet: frequent.
Solanum nigrum black nightshade: occasional.
Solidago canadensis Canadian golden rod: common garden escape.
Sonchus arvensis perennial sowthistle: frequent.
Sonchus asper prickly sowthistle: common.
Sonchus oleraceus smooth sowthistle: common.
Sorbus aria common whitebeam: rare, one tree in woodland.

Sorbus aucuparia rowan: frequent, bird-sown.
Sorbus aria × *aucuparia* = *Sorbus* × *thuringiaca*: occasional bird-sown saplings.
Sparganium erectum ssp. *erectum* branched bur-reed: by Beverley Brook.
Spergularia rubra sand spurrey: rare, sandy areas.
Stachys sylvatica hedge woundwort: frequent, rough grassland.
Stellaria graminea lesser stitchwort: frequent, heathland.
Stellaria media common chickweed: common.
Stellaria pallida lesser chickweed: rare, in lawn near pond.
Symphoricarpos albus snowberry: common.
Symphytum orientale white comfrey: occasional, near houses.
Syringa vulgaris lilac: garden outcast, suckering.
Tanacetum parthenium feverfew: occasional, near houses.
Tanacetum vulgare tansy: spreading, Mill Hill.
Taraxacum officinale agg. dandelion: common.
Taxus baccata yew: planted, seedlings common.
Thuja orientalis red cedar: planted in cemetery.
Tilia cordata small-leaved lime: planted, hedgerows.
Tilia × *europaea* lime: frequently planted.
Tilia 'Petiolaris' pendent silver lime: one planted tree.
Tilia platyphyllos large-leaved lime: planted near pond.
Tragopogon pratensis ssp. *minor* goat's-beard: common.
Tragopogon pratensis ssp. *pratensis*: rare.
Trifolium dubium lesser trefoil: common.
Trifolium hybridum alsike clover: occasional.
Trifolium pratense red clover: frequent, rough grassland.
Trifolium repens white clover: occasional.
Tripleurospermum inodorum scentless mayweed: common.
Tristagma uniflora spring starflower: established garden escape, Mill Hill.
Tussilago farfara coltsfoot: common, waste ground.
Typha angustifolia bulrush: planted by pond.
Ulex europaeus gorse, common.
Ulmus glabra wych elm: young trees, frequent.
Ulmus minor ssp. *minor* small-leaved elm: frequently regenerating.
Ulmus minor ssp. *sarniensis* Jersey elm: frequently planted and suckering.
Ulmus procera English elm: regenerating, mostly on roadsides.
Urtica dioica stinging nettle: abundant.
Valerianella locusta common cornsalad: rare.
Verbascum blattaria moth mullein: rare.
Verbascum thapsus greater mullein: uncommon.
Veronica arvensis wall speedwell: occasional.
Veronica beccabunga brooklime: planted by pond.
Veronica chamaedrys germander speedwell: rare, in old cemetery.
Veronica filiformis slender speedwell: uncommon, in meadow.
Veronica hederifolia ssp. *lucorum* ivy-leaved speedwell: abundant.
Veronica persica common field speedwell: common.
Vicia hirsuta hairy tare: casual.
Vicia sativa ssp. *segetalis* common vetch: common.
Vicia tetrasperma smooth tare: casual.
Vinca major greater periwinkle: frequent garden escape.
Vinca minor lesser periwinkle: uncommon garden escape.
Viola odorata sweet violet, a large early flowering var.: frequent near houses.
Vulpia bromoides squirreltail fescue: common.
Vulpia myuros rat's-tail fescue: occasional.

Conclusions

Any botanist running an eye down the list will be struck by a completely changed floristic picture from that indicated by earlier writers. De Crespigny (1876) had described the Common as 'more or less covered in furze, broom, briars, bracken and heath'; Paley (1882) noted, 'a good many small ponds, streamlets, springs and boggy places'; while Robert Hunter (1844–1913), in his book on London Commons, says that 'it has no copse wood and scarcely a tree worth the name'.

None of these descriptions holds good today. The current list does show the persistence of at least some elements of the heathland flora, but wetland species are greatly diminished, as a result, mainly, of nineteenth- and twentieth-century drainage schemes which included running the Beverley Brook through a culvert and filling in the other stream, the Rythe. The only unculverted part of the Brook that remains runs along Laurel Road, and entries for Beverley Brook in the species list are all from there. Woodlands have developed in several areas, many fine trees have been planted and interesting areas of undergrowth have grown around and beneath them; there has been invasion of heathy areas by scrub, consisting mainly of oak, birch and *Prunus* species, since cattle no longer graze there. Meadow plants and many bird-sown shrubs and trees grow in the old cemetery, opened in 1864 and left derelict since 1924; across the railway line a great variety of colourful species grew up in the railway goods yard after it was abandoned and its concreted floor gradually broke up. Access here was forbidden and some work carried out a few years ago. A number of plants were destroyed during the working period; many may recover. At the time of writing access is again possible, if unofficial.

But perhaps the most striking aspect of the modern list is the large number of garden escapes or throwouts, not to mention bird-sown shrubs having their origins in gardens. The Common was an attractive place to live, big houses with gardens were built to surround it — Ranelagh Avenue, Queens Ride, Vine Road — and the prevalence of garden escapes has been the natural result. In this and in other ways therefore the flora of the Common has developed since Paley wrote.

The list has been made as complete as possible now, but the flora will not be static and botanists on the Common are more than likely to find additional species at any time. For those who mourn the reduction of the old flora and deplore alien invasion, there is always a hope of refinding the well-known native plants of the past. The present author remembers coming across *Genista anglica* and *Salix repens* on a family picnic about forty years ago. Both vanished, but *Salix repens* was refound last year and future surprises are never impossible. It is hoped that the present list will be of use in evaluating future change.

Acknowledgements

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References

BREWER, J. A. 1863. *Flora of Surrey.* John van Voorst, London.
BURTON, R. M. 1983. *Flora of the London Area.* London Natural History Society.
DE CRESPIGNY, E. 1876. *New London flora.* Hardwicke & Bogue, London.
KENT, D H. and LOUSLEY, J. E. 1951–7. A hand list of the plants of the London Area. *Lond. Nat.* **30–36** (Suppls), 368 pp.
LOUSLEY, J. E. 1976. *Flora of Surrey.* David & Charles, Newton Abbot.
PALEY, F. A. 1882. Nearly 200 flowering plants collected on Barnes Common, 1877–81. *West London Observer,* 18 February.
SALMON, C. E. 1931. *Flora of Surrey.* G. Bell & Sons, London.
STACE, C. 1997. *New flora of the British Isles.* Ed. 2. Cambridge University Press.
WHITEHOUSE, M. 1952. The present flora of Barnes Common, Surrey. *Lond. Nat.* **31**: 17–19.

Further additions to the flora of Hyde Park and Kensington Gardens

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Summary

Forty-one species, one hybrid and two forms are added to the vascular plant records for Hyde Park and Kensington Gardens which commenced in 1988 (Wiltshire 1994, 1996). Six species result from establishment of reed-beds in The Long Water, seven are *Taraxacum* dandelions, and four are aliens of birdseed origin. About fourteen others surfaced as a consequence of reduced mowing and of soil improvement measures, including notably *Campanula rotundifolium* harebells and *Koeleria macrantha* crested hair-grass. Among other finds of interest was a colony of *Verbascum blattaria* moth mullein. *Lathyrus pratensis* meadow vetchling and *Geranium pyrenaicum* hedgerow cranesbill, recorded for the first time in Kensington Gardens, are included here, as are unusual forms of *Centaurea nigra* common knapweed and *Lactuca serriola* prickly lettuce. *Apium graveolens* wild celery, noted in 1994 (Burton 1995) but inadvertently omitted from these records, is now added.

The moss *Pohlia lescuriana* is an addition to the bryophyte flora.

As previously, Hyde Park and Kensington Gardens combined are referred to as the 'park'.

Introduction

The 1996 season was hot and dry, and the only new plant noted was a skimpy *Senecio viscosus* sticky groundsel. In 1997 mowing was reduced over large areas of the park and, despite another hot dry summer, remarkable growth took place on Buck Hill in Kensington Gardens. *Achillea millefolium* yarrow bloomed over much of the site, a display which gave pleasure to the public, but the plants of botanical interest were inconspicuous on the fringes of the southern part. In heathy ground near the Arch enclosure a vigorous patch of *Campanula rotundifolia* harebells appeared, having apparently been long suppressed by mowing. The last park record of these had been Warren's in 1871, more or less in the same area, when he found five or six plants 'north of the Magazine . . . most interesting survivors of the original Park herbage' (Warren 1871). Similarly, in a rough grassy strip by Buck Hill Walk, *Rumex pulcher* fiddle dock, rare and decreasing in Middlesex (Kent, in press), grew into bushy plants. Usually mown, it had been detected here only once before, in 1989 (Wiltshire 1994).

During the rainy season of 1998, when mowing was again suspended, these plants continued to flourish, and other interesting species appeared in both locations. Near the harebell patch *Koeleria macrantha* crested hair-grass, very rare in Middlesex (Kent, in press), was found. Once again, the only previous park record of this is Warren's. In Kensington Gardens he noted 'three or four tufts in flower this year, close to the iron hurdles which bound the hay-grass on the east side of the Palace . . . This was to me a most unexpected addition to our list' (Warren 1871).

Near the fiddle dock site, new species included notably *Trifolium campestre* hop trefoil, as well as several vetches. *Erodium cicutarium* common storksbill and *Geranium pusillum* small-flowered cranesbill also flourished here. Nearby, on bare ground where coarse grasses had been cleared with herbicide, an abundance of opportunist weeds sprang up. Among them were *Papaver dubium* ssp. *dubium* long-headed poppy, *Spergula arvensis* corn spurrey, *Viola tricolor* ssp. *tricolor* wild pansy, and *Senecio sylvaticus* heath groundsel (this appeared simultaneously at two other Kensington Gardens sites). Two curiosities seen in this patch were the pseudoradiate form of *Centaurea nigra* common knapweed, and the *serriola* form, with deeply runcinate-pinnatifid leaves, of *Lactuca serriola* prickly lettuce (Rich and Jermy 1998). A similar patch beside Inverness Walk produced some of the same weeds, including *Senecio sylvaticus* heath groundsel, and also *Myosoton aquaticum* water chickweed, *Erysimum cheiranthoides* treacle mustard, *Sherardia arvensis* field madder and *Galeopsis bifida* bifid hemp-nettle. Scarification of compacted soil resulted in the appearance in 1998 of a few plants of *Spergularia rubra* sand spurrey near Speke's monument. Previously reported in Kensington Gardens in 1866, this was believed to have become extinct here (Kent 1975).

Several additions to the park flora derive from measures recently undertaken to improve water quality in The Long Water and The Serpentine. St Agnes's well, by the Italian Gardens, was rebored to a depth of 130 metres and now contributes a fresh supply, an oxygenation system has been installed, and reed-beds have been established in The Long Water. *Bolboschoenus maritimus* sea club-rush, *Cyperus longus* galingale, *Phragmites australis* common reed, and *Typha angustifolia* lesser bulrush have been introduced, bringing with them *Berula erecta* lesser water-parsnip and *Veronica beccabunga* brooklime.

An opportunity to visit the Arch enclosure in 1998 revealed a remarkable colony of some hundred plants of *Verbascum blattaria* moth mullein, an alien which is rare and usually impermanent in London. Coincidentally, a similar community was found around the same period at a disused railway site in Haringey (D. Bevan, pers. comm.). Birdseed aliens which appeared at popular feeding sites included *Fagopyrum esculentum* buckwheat, *Coriandrum sativum* coriander, and *Eragrostis cilianensis* stink-grass in the Peter Pan enclosure, and *Carthamus tinctorius* safflower near Palace Gate.

The recent publication of the handbook *Dandelions of Great Britain and Ireland* (Dudman and Richards 1997) prompted an attempt to study these plants in the park. Material was collected during April 1999, mainly from areas of grassland and along railings. From this, seven species were expertly determined by Andrew Dudman — one from Section *Erythrosperma,* three from Section *Hamata,* and three from Section *Ruderalia.* One specimen is still under investigation. There do not appear to be any previously published details of *Taraxacum* in the park, other than a reference by Warren (1871) to 'var. *Erythrospermum* Andrz.' in Hyde Park.

An addition to the bryophyte flora of the park is the inconspicuous moss *Pohlia lescuriana*. It was found in 1998 among *Campylopus* species under oaks near Lancaster Gate and on heathy ground west of the Serpentine Gallery.

List of species

Particulars of additions from 1996 to April 1999, and including *Apium graveolens* wild celery from 1994, are given below. Earlier records by J.B.L. Warren (1871), D.H. Kent (1950) and D.E. Allen (1965) are indicated by the marginal initials W, K and A. Arrangement and nomenclature of vascular plants in general are according to Stace (1997), and of dandelions according to Dudman and Richards (1997).

H = Hyde Park and **K** = Kensington Gardens.

VASCULAR PLANTS

PAPAVERACEAE

Papaver dubium ssp. *dubium* long-headed poppy. **K** – in weedy patch near Magazine, June 1998.

PORTULACACEAE

Montia fontana ssp. *chondrosperma* blinks. **H** – sparsely on sandy ground west of Bowling Green, April 1999. In 1666 this was 'frequent' in the park, according to Christopher Merrett (1666).

CARYOPHYLLACEAE

Cerastium semidecandrum little mouse-ear. **K** – on disturbed sward near Magazine, May 1998 (det. S. Reynolds).

W A *Spergula arvensis* corn spurrey. **H** – on disturbed heathy soil in Meadow, July 1998. K – on disturbed soil near Speke's monument and in weedy patch near Magazine, July 1998.

W A *Spergularia rubra* sand spurrey. **K** – about a dozen plants on disturbed soil near Speke's monument, July 1998. Last recorded in Kensington Gardens in 1866 (Kent 1975).

POLYGONACEAE

Fagopyrum esculentum buckwheat. **K** – a fine plant in disturbed ground on south side of Peter Pan enclosure, June 1997 (det. R.M. Burton).

Fallopia japonica var. *compacta* a dwarf variety of Japanese knotweed. **K** – in Arch enclosure, July 1998.

Rumex × *pratensis* (*R. crispus* × *R. obtusifolius*) hybrid dock. **K** – one plant in rough grass on Buck Hill, July 1998 (det. G. Kitchener).

VIOLACEAE

Viola tricolor ssp. *tricolor* wild pansy. **K** – in weedy patch near Magazine, June 1998; on scarified ground near Physical Energy statue May 1999.

FABACEAE

Vicia tetrasperma smooth tare. **K** – in weedy patches near Magazine and by Inverness Walk, July 1998.

W K A *V. sativa* ssp. *segetalis* common vetch. **K** – single plant in rough grass on Buck Hill, June 1998; spreading rapidly, May 1999. Warren, Kent and Allen all recorded *V. angustifolia*, which is now included in *V. sativa*.

K *Lathyrus pratensis* meadow vetchling. **K** – in Arch enclosure, July 1998. First record for Kensington Gardens. Noted in Hyde Park by Kent, and planted in The Meadow there (unsuccessfully) in 1995.

Trifolium campestre hop trefoil. **K** – a small colony in rough grass on Buck Hill, July 1998.

GERANIACEAE

Geranium pyrenaicum hedgerow cranesbill. **K** – in rough grass on Buck Hill and in weedy patch near Magazine, June 1998. First record for Kensington Gardens. A plant in Hyde Park, 1991 (Wiltshire 1994).

APIACEAE

Coriandrum sativum coriander. **K** – single plant in disturbed ground on south side of Peter Pan enclosure, June 1997 (det. R.M. Burton).

Berula erecta lesser water-parsnip. **K** – in a clump of recently introduced *Phragmites australis* common reed in The Long Water, July 1998.

Apium graveolens wild celery. **H** – single plant by Nursery enclosure railings, July 1994 (Burton 1995).

BORAGINACEAE

Echium vulgare viper's bugloss. **H** – introduced at western end of Rotten Row, July 1998.

Pentaglottis sempervirens green alkanet. **K** – single plant on Buck Hill by West Carriage Drive railings, September 1997.

LAMIACEAE

A *Galeopsis bifida* bifid hemp-nettle. **K** – in weedy patch by Inverness Walk, August 1998.

PLANTAGINACEAE

W *Plantago coronopus* buck's-horn plantain. **H** – about fifty plants on parched trampled turf near Speakers' Corner, July 1999.

SCROPHULARIACEAE

Verbascum blattaria moth mullein. **K** – about 100 plants in Arch enclosure, July 1998.

W *Veronica beccabunga* brooklime. **K** – in The Long Water among recently introduced *Bolboschoenus maritimus* sea club-rush, June 1998.

CAMPANULACEAE

W *Campanula rotundifolia* harebell. **K** – over 100 flowering plants in a patch of heathy ground about 2 m square on Buck Hill, July 1997 and 1998.

ASTERACEAE

Centaurea nigra common knapweed (pseudoradiate form). **K** – in weedy patches near Magazine and by Inverness Walk, July 1998. An unusual form (Figure 1).

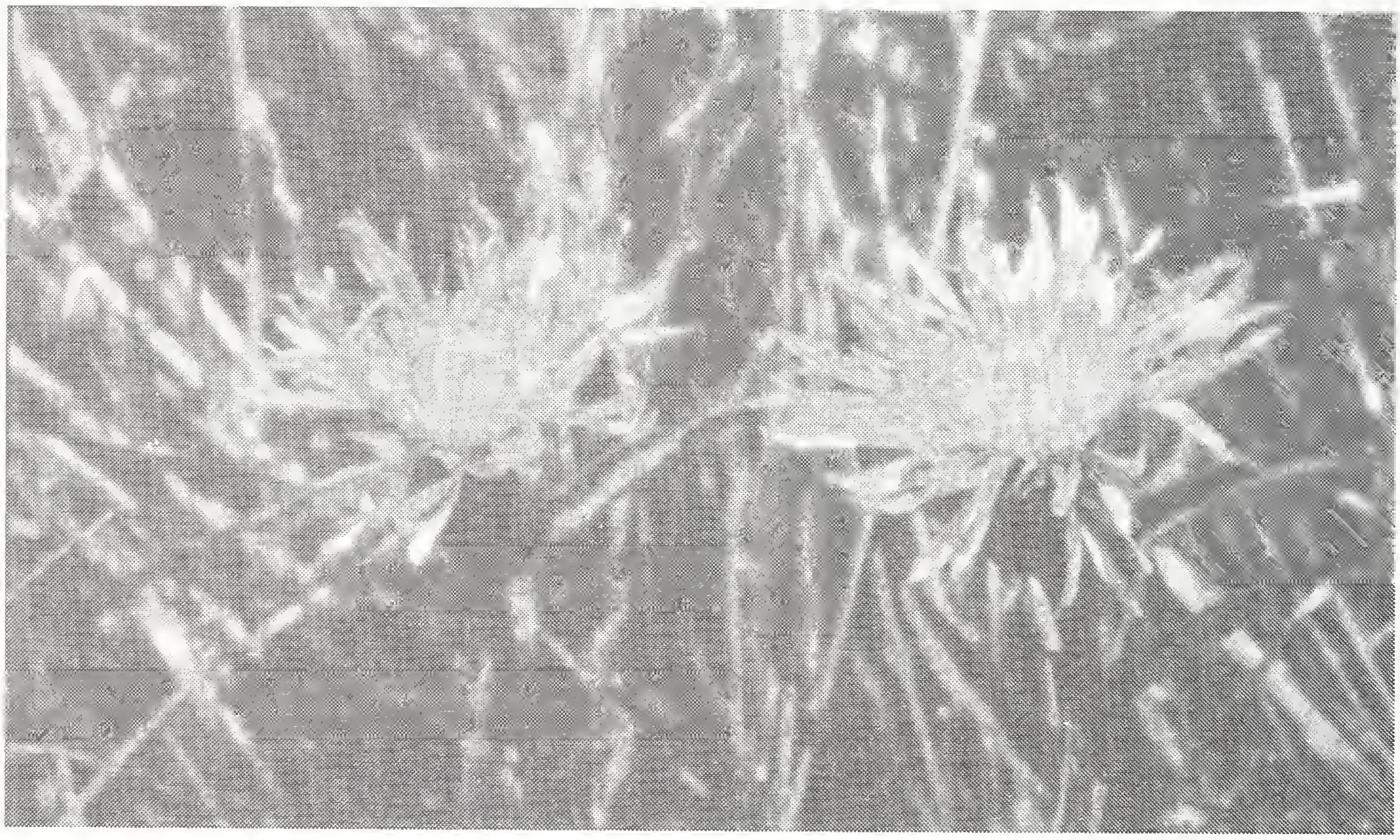

FIGURE 1. Pseudoradiate form of *Centaurea nigra* common knapweed on Buck Hill, Kensington Gardens, August 1998. *Photo: Elinor Wiltshire*

Carthamus tinctorius safflower. **K** – a single plant near Palace Gate, July 1997 (det. R.M. Burton).

Lactuca serriola forma *serriola* prickly lettuce. **K** – a single plant of the less usual form of this species, in weedy patch near Magazine, August 1998 (Figure 2).

Taraxacum dandelions:

Sect. *Erythrosperma*: *T. glauciniforme*. **H** – by tennis courts.

Sect. *Hamata*: *T. hamatum*, *T. pseudohamatum*, *T. atactum*. **H** – in meadow.

Sect. *Ruderalia*: *T. sublaeticolor*. **H** – western end of Rotten Row; **K** – on Buck Hill.

T. undulatiflorum. **H** – in Meadow.

T. lingulatum ('probably'). **K** – near Albert Memorial.

Mycelis muralis wall lettuce. **K** – a single plant by railings of Peter Pan enclosure, July 1998.

Pilosella officinarum mouse-ear-hawkweed. **K** – a few plants on heathy ground on Buck Hill, June 1998.

Tanacetum vulgare tansy. **K** – a fine plant on long grass west of Serpentine Gallery, July 1998 (Figure 3).

Senecio sylvaticus heath groundsel. **K** – in weedy patches near Magazine and Inverness Walk, and in Arch enclosure, July 1998.

K A *S. viscosus* sticky groundsel. **K** – small plant in shrub border by Marlborough Gate, June 1996.

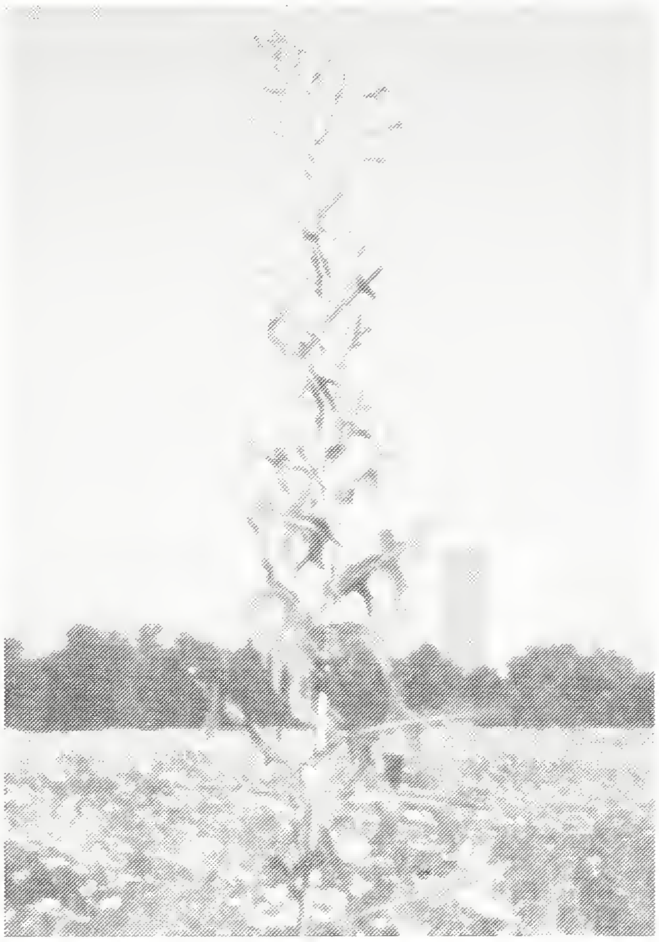

FIGURE 2. *Lactuca serriola* forma *serriola* prickly lettuce on Buck Hill, Kensington Gardens, August 1998. *Photo: Elinor Wiltshire*

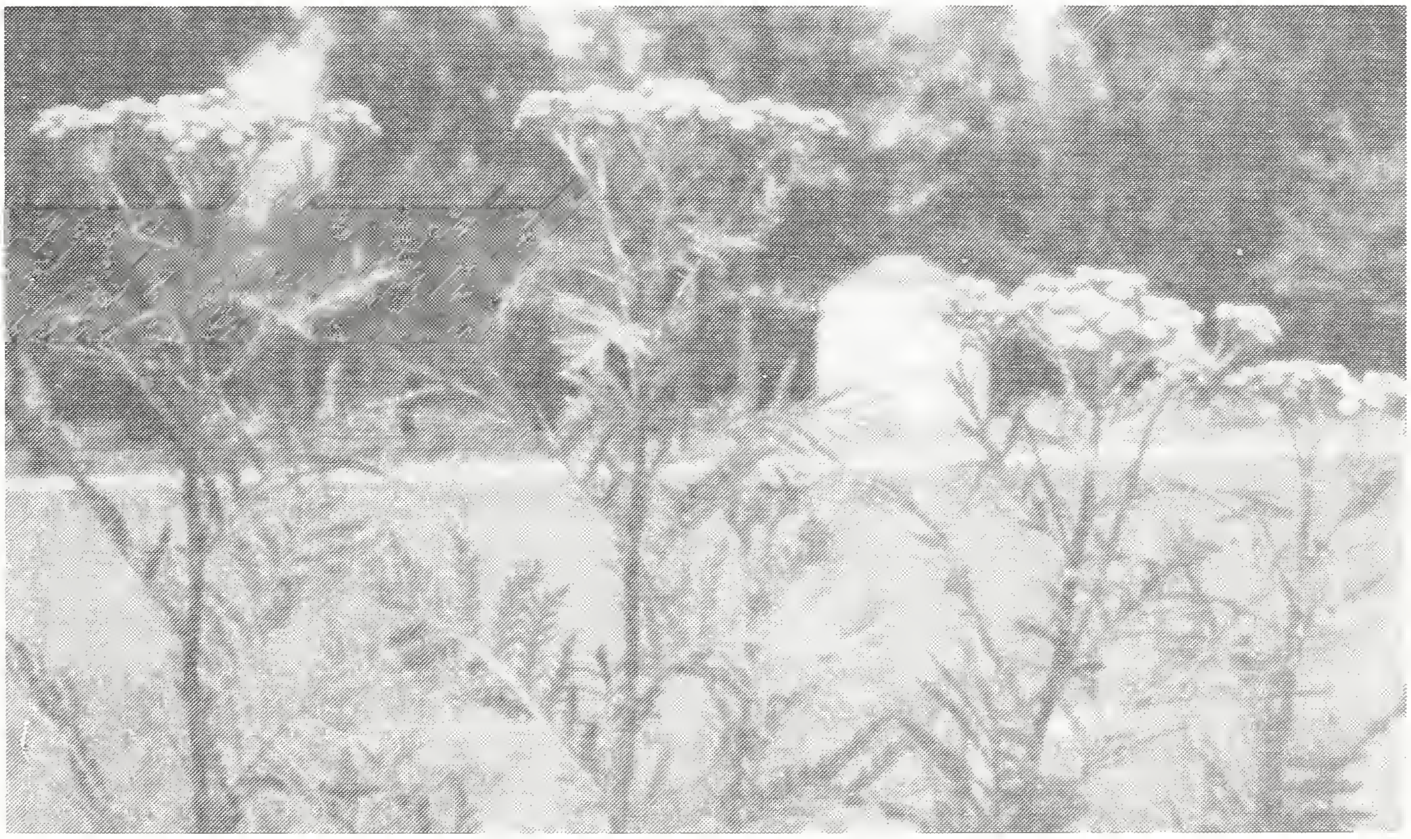

FIGURE 3. *Tanacetum vulgare* tansy in Kensington Gardens, August 1998. *Photo: Elinor Wiltshire*

CYPERACEAE

Bolboschoenus maritimus sea club-rush. **K** – recently introduced to The Long Water.

Cyperus longus galingale. **K** – introduced to The Long Water a few years ago.

POACEAE

W *Koeleria macrantha* crested hair-grass. **K** – a small patch on heathy ground on Buck Hill, June 1998. Very rare in Middlesex (Kent, in press).

Phragmites australis common reed. **K** – recently introduced to The Long Water.

Eragrostis cilianensis stink-grass. **K** – two plants by railings on south side of Peter Pan enclosure, September 1997 (det. N. Robson and R. Vickery).

TYPHACEAE

Typha angustifolia lesser bulrush. **K** – recently introduced to The Long Water.

BRYOPHYTE

BRYACEAE

Pohlia lescuriana (Sull.) Grout. **K** – this inconspicuous moss, added to the British flora in 1965, was recorded on heathy ground near Lancaster Gate and west of Serpentine Gallery, January 1998.

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References

ALLEN, D.E. 1965. The flora of Hyde Park and Kensington Gardens. *Proc. bot. Soc. Br. Isl.* **6**: 1–20.

BURTON, R.M. 1995. Botantical records for 1994. *Lond. Nat.* **74**: 176.

DUDMAN, A.A. and RICHARDS, A.J. 1997. *Dandelions of Great Britain and Ireland.* London.

KENT, D.H. 1950. Notes on the flora of Kensington Gardens and Hyde Park. *Watsonia* **1**: 296–300.

KENT, D.H. 1975. *The historical flora of Middlesex.* The Ray Society, London.

KENT, D.H. In press. Supplement to *The historical flora of Middlesex.* The Ray Society, London.

MERRETT, C. 1666. *Pinax rerum naturalium britannicarum.* London.

RICH, T.C.G. and JERMY, A.C. 1998. *Plant crib 1998.* BSBI, London.

STACE, C. 1997. *New flora of the British Isles.* Cambridge University Press.

WARREN, J.B.L. 1871. The flora of Hyde Park and Kensington Gardens. *J. Bot., Lond.* **9**: 227–238.

WARREN, J.B.L. 1875. Kensington Gardens plants. *J. Bot., Lond.* **13**: 336.

WILTSHIRE, E. 1994. The flora of Hyde Park and Kensington Gardens, 1988–1993. *Lond. Nat.* **73**: 37–60.

WILTSHIRE, E. 1996. Additions to the flora of Hyde Park and Kensington Gardens in 1995. *Lond. Nat.* **75**: 41–43.

Bryophytes of Hounslow Heath, 1995–1999

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Summary

Sixty-one bryophyte species, fifty-five mosses and six liverworts were noted during occasional visits to Hounslow Heath from 1995 to 1999. These include *Pogonatum aloides,* a new Middlesex record, and local rarities *Polytrichum commune, P. piliferum, Fissidens viridulus, Orthotrichum lyellii, Cryphaea heteromalla* and *Lophozia bicrenata.* Habitats are described briefly and reference is made to previous records.

Habitats

Present-day Hounslow Heath is a remnant of the Forest of Staines, which once covered much of west Middlesex. From Norman times the forest was a royal hunting ground, which was gradually eroded with the spread of farms and houses. Hounslow Heath escaped such development because of its strategic importance as a military training ground — Cromwell's army of 20,000 men encamped here. Army ownership continued until after the Second World War, by which time most of the surrounding area had been built over. During the 1950s large-scale gravel extraction took place, and was followed by infill of the pits with domestic and other rubbish. Eventually these were covered over and wildlife began to reappear. As the site was unsuitable for housing, during the 1980s it was managed by Hounslow Borough Council as a nature reserve. In 1992 82 hectares (197 acres) of the Heath was granted Local Nature Reserve status. The western portion, along the River Crane and its associated channels, is a public golf course (Figure 1).

As a very full description of Hounslow Heath Local Nature Reserve and its vascular plants was published recently in *The London Naturalist* (Holt 1998), its habitats are referred to only briefly here. The infilled areas, which comprise most of the eastern and central part of the Reserve, are mainly covered by coarse grasses and scrub, unsuited to bryophytes. The western side contains some eight hectares (20 acres) of heath-type vegetation, including characteristic bryophytes. In places sheets of *Polytrichum juniperinum* are conspicuous, especially in April when the sun shines on the red-gold thatch-like calyptras, or 'caps', of the little plants. In pre-Linnean times this species was commonly known as goldilocks and little golden maidenhair (Figure 2).

The fenced-off Heather Pen, which protects remnants of *Calluna vulgaris* heather, also benefits mosses and liverworts. There are patches of *Polytrichum piliferum,* uncommon in Middlesex, and *Hypnum jutlandicum,* while hidden beneath individual *Calluna* clumps specialized bryophyte communities may be found. These include the mosses *Campylopus pyriformis, Pohlia nutans* and *Bryum rubens,* with the thread-like liverworts *Cephaloziella divaricata* and *Lophozia bicrenata* entwined among them. In the adjacent heather reseeding area, where topsoil had been stripped away a few years before, *Pleuridium acuminatum,* uncommon in Middlesex, appeared during 1998.

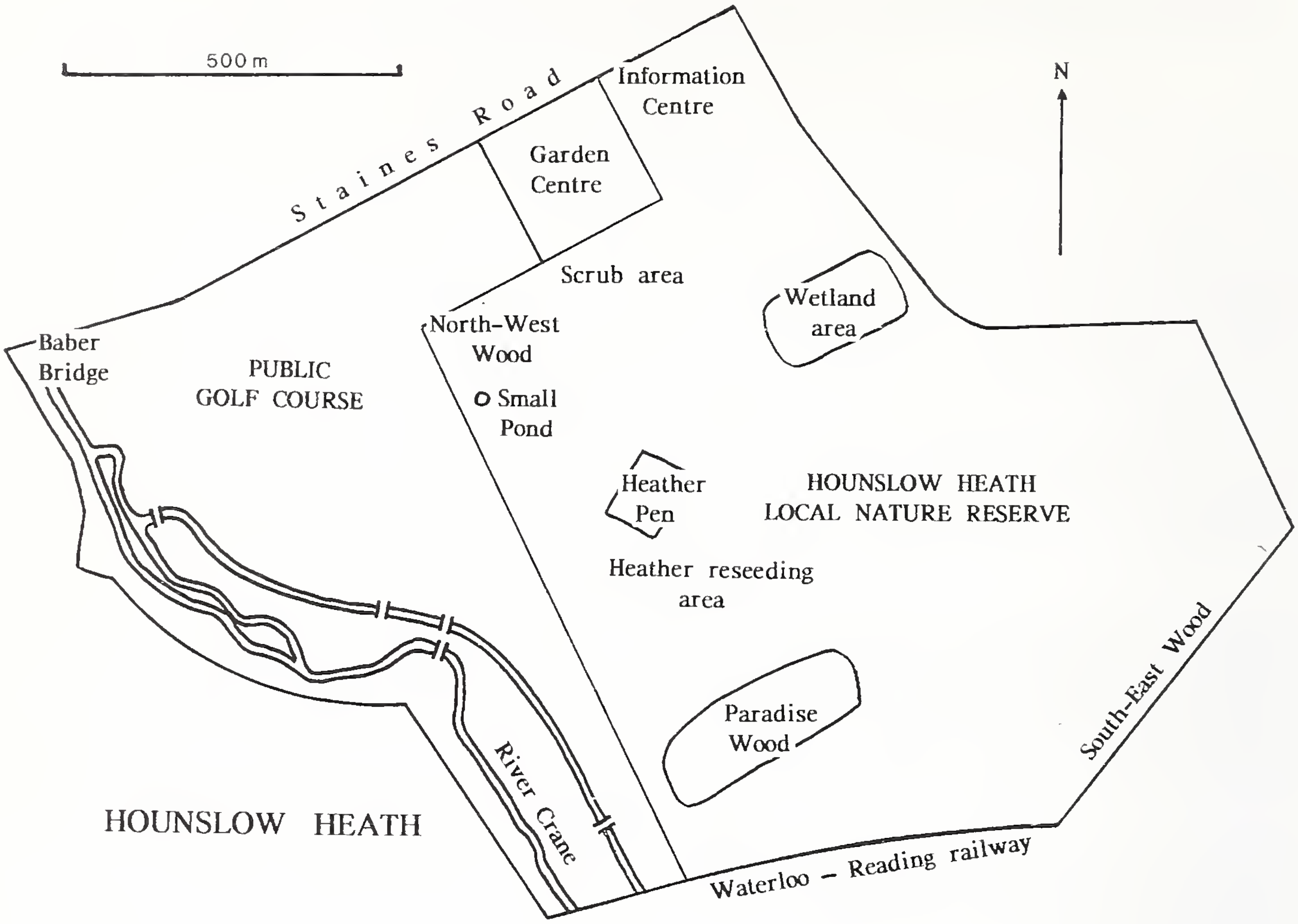

FIGURE 1. Hounslow Heath Local Nature Reserve.

The area of grass heath in the south-west corner of the Reserve, bordering the railway, is another good moss habitat. In 1995 *Polytrichum commune* was an interesting find here. Although nationally common on wet moorland, this conspicuous moss (20 cm or taller) is rare in Middlesex due to drying-out of suitable territories. The specimen consisted of only a few shoots, which did not reappear during the subsequent dry seasons. But happily, in 1999, as a result of scrub clearance, a flourishing colony was revealed nearby, sharing a patch of damp ground with *Juncus squarrosus* heath rush. *P. formosum* occurs among *Molinia caerulea* purple moor-grass clumps towards South-East Wood. *P. juniperinum* is locally abundant and *P. piliferum* occasional.

Some good finds were made in the North-West Wood area. *Pogonatum aloides*, a new Middlesex record (Rothero 1999), was on the clay bank of the damp (and sometimes flooded) ditch which divides the north side of the wood from the golf course. In the wood itself, *Cryphaea heteromalla* grew on an elder branch, while an old *Quercus robur* pedunculate oak by the nearby Small Pond hosts various other epiphyte mosses, including the Middlesex rarity *Orthotrichum lyellii*. Around the moist edge of the pond *Pohlia annotina* is plentiful.

The wetland in the north-east of the Reserve accounts for a few other species, including the moss *Drepanocladus aduncus* and the liverwort *Aneura pinguis*.

Outside the Reserve, on the west bank of the River Crane near Baber Bridge, a shady clay path provides an ideal substrate for the alien moss *Hennediella macrophylla*. Believed to have originated in New Zealand, it was first recorded in Britain in 1965. The first Middlesex sighting was by M.O. Hill in 1968, on a shaded path under trees above flood level by the River Crane near Heathrow Airport (Kent, in press). It is now present at various points along the river, and appears with increasing frequency in inner London parks.

Past records

The earliest bryophyte records from the Heath are those of William Hudson (1762) in his *Flora anglica,* the first standard work on English botany. He names two liverworts: *Anthoceras punctatus,* which may have been the very similar *A. agrestis* (Kent, in press), and *Blasia pusilla.* Both are associated with damp clay. Neither has since been recorded for Middlesex, and both are very scarce generally in southern England.

The next records are from the 1920s, made by Paul Richards (1928). He published a comprehensive study of Middlesex bryophytes and refers to the Heath:

> 'There is now no common to represent the formerly extensive Hounslow Heath in the south of the county, all of it having been converted into drilling-grounds, fields, gravel-pits, etc. A field however was found near the site of the old heath on which gravel waste had been tipped and vegetation of a grass-heath character had grown up. This vegetation cannot of course be lineally descended from the old vegetation of Hounslow Heath. Mosses are fairly abundant, especially on top of the overgrown mounds of gravel, and they are nearly all typical grass-heath species.'

In current nomenclature these are *Polytrichum piliferum, P. juniperinum, Atrichum undulatum, Ceratodon purpureus, Dicranum scoparium, Pohlia nutans, Plagiomnium affine, Scleropodium purum, Hypnum cupressiforme* and *Rhytidiadelphus squarrosus.* He also recorded the liverwort *Lophocolea bidentata.* His specimens are in the British Bryological Society's herbarium in The National Museum of Wales.

In 1950 R. A. Boniface confirmed the continued presence of *Polytrichum piliferum* and found the heathland liverwort *Lophozia bicrenata* (Kent, in press). In 1967 this liverwort was noted again by C.C. Townsend (Kent, in press).

J.C. Gardiner collected *Cephaloziella divaricata* in 1980 and *Lophozia bicrenata* in 1981, both 'on sandy ground'. Also in 1981, he and M. Milnes-Smith found the uncommon moss *Amblystegium tenax* 'on stone-work by River Crane, west side of Hounslow Heath'. Specimens of these are in the Cryptogamic Herbarium of The Natural History Museum (Wiltshire and Ellis 1995). In 1983 he found *Gymnocolea inflata* on the Heath (Kent, in press).

Records 1995–1999

Sixty-one bryophyte species were noted during this period — fifty-five mosses and six liverworts. They include several which are uncommon in Middlesex. Of these the rarest is the moss *Pogonatum aloides.* It has been accepted as a new Middlesex record (Rothero 1999), replacing John Benbow's Uxbridge record of 1881 (Wiltshire and Ellis 1995). *Polytrichum commune* is now scarce and *P. piliferum* is very local. *Pleuridium acuminatum* is rare in Middlesex. The only other Middlesex records of *Fissidens viridulus* are from the Harefield area. *Hennediella macrophylla,* although spreading through the Thames Valley, is still uncommon. *Orthotrichum lyellii* and *Cryphaea heteromalla* are epiphytes which have long been rare in the London area but are reappearing as sulphur dioxide levels fall. The liverwort *Lophozia bicrenata* has not been recorded at any other site in Middlesex.

List of species

The following species were recorded during the period 1995–1999. *Plagiomnium affine, Amblystegium tenax, Rhytidiadelphus squarrosus* and *Gymnocolea inflata* were not refound. Locations are indicated but are not necessarily the only possible sites.

Order and nomenclature are in accordance with Blockeel and Long (1998). Rarity status is according to Kent (in press).

MOSSES

POLYTRICHACEAE

Pogonatum aloides. Rare. A few plants in damp shaded ditch in North-West Wood, May 1997. New vice-county record (Rothero 1999).

Polytrichum formosum. Small colonies near railway boundary among *Molinia caerulea* purple moor-grass.

Polytrichum commune. Rare. A few plants near railway boundary, April 1995; a flourishing colony in same area, April 1999.

Polytrichum piliferum. In Heather Pen and near railway boundary, occasional elsewhere with *P. juniperinum.* Scarce in Middlesex.

Polytrichum juniperinum. Locally abundant on heathy ground (Figure 2).

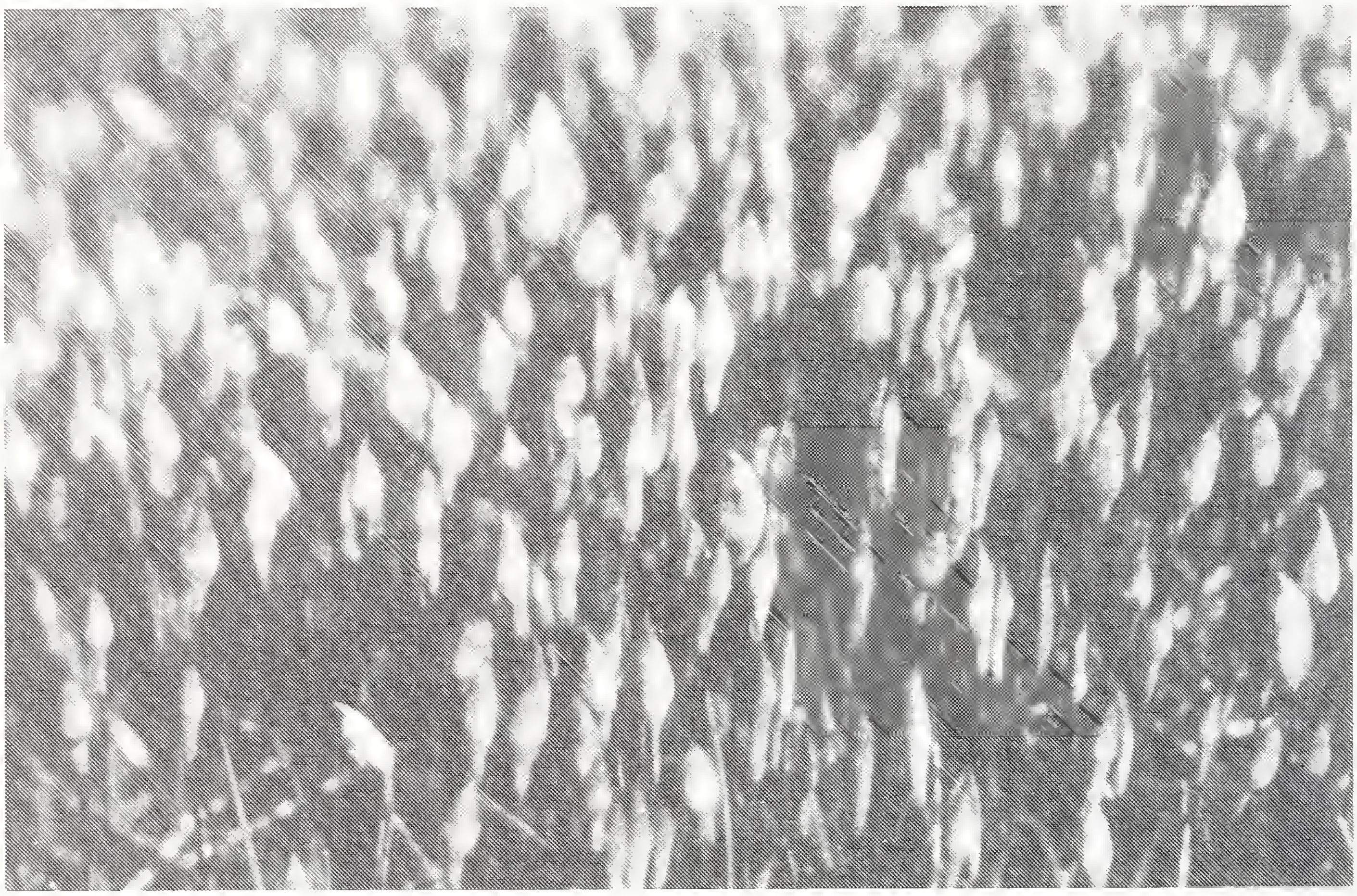

FIGURE 2. *Polytrichum juniperinum* capsules on Hounslow Heath, still protected by their hairy calyptras, April 1999. *Photo: Elinor Wiltshire*

Atrichum undulatum. Locally abundant in ditch in North-West Wood, sporadic on clay under scrub.

DICTRICHACEAE

Pleuridium acuminatum. Rare. Locally abundant in heather reseeding area, March 1998.

DICRANACEAE

Ceratodon purpureus. Frequent.

Dicranella heteromalla. Occasional on bare clay under scrub or trees.

Dicranoweisia cirrata. Occasional on bark, especially of elder or hawthorn.

Dicranum scoparium. Sporadic on heathy ground.

Campylopus pyriformis. Occasional under *Calluna.*

Campylopus introflexus. Occasional. An alien species, first recorded in England in 1941 but now widespread.

FISSIDENTACEAE

Fissidens viridulus. Rare. On bare soil at side of ditch in North-West Wood, May 1997 (det. L.T. Ellis).

Fissidens bryoides. Frequent on bare shaded ground.

Fissidens taxifolius. Frequent on bare shaded ground.

POTTIACEAE

Pseudocrossidium hornschuchiana (*Barbula hornschuchiana*). Occasional among other small mosses.

Bryerythrophyllum recurvirostrum. Scarce. In thin sward near Small Pond, April 1995; on elder branch by golf course boundary, December 1997.

Barbula convoluta. Frequent on bare soil and at path edges.

Barbula unguiculata. Common on bare ground.

Didymodon fallax (*Barbula fallax*). Scarce. In sward near Small Pond, May 1997.

Tortula muralis. Occasional on old concrete.

Hennediella macrophylla. On clay footpath by west bank of River Crane, south of Baber Bridge, May 1997. This alien moss is now at several sites along the river, including Donkey Wood and Crane Park.

Syntrichia intermedia (*Tortula intermedia*). On old concrete by Nature Trail near North-West Wood.

GRIMMIACEAE

Grimmia pulvinata. On old concrete by Nature Trail near North-West Wood. Rare on trees, but a few tufts were found on elder bark, July 1997.

FUNARIACEAE

Funaria hygrometrica. Common on disturbed ground, especially where fire-damaged.

BRYACEAE

Leptobryum pyriforme. On disturbed ground in wetland, October 1997 (det. L.T. Ellis).

Pohlia nutans. Frequent on heathy ground, especially among *Calluna* and near railway boundary.

Pohlia annotina. Scarce. In sward near Small Pond, April 1995 (det. L.T. Ellis); abundant on damp clay around Small Pond, April 1999.

Pohlia melanodon (*P. carnea*). On shaded path by River Crane, May 1997.

Bryum capillare. Widespread on tree bark, by path edges and in thin sward.

Bryum caespiticium. Frequent on bare ground.

Bryum argenteum. Edge of concrete roadway and other disturbed sites.

Bryum gemmiferum. On bare clay in wetland.

Bryum bicolor. Along edge of concrete roadway.

Bryum rubens. Occasional at path edges, in thin turf and under *Calluna*.

MNIACEAE

Mnium hornum. On ground in South-East Wood.

AULACOMNIACEAE

Aulacomnium androgynum. On decaying bark in Paradise Wood, July 1997.

ORTHOTRICHACEAE

Orthotrichum affine. Occasional on elder bark.

Orthotrichum lyellii. Rare. A few shoots on pedunculate oak by Small Pond.

Orthotrichum diaphanum. Occasional on elder or hawthorn bark.

CRYPHAEACEAE

Cryphaea heteromalla. A few shoots among *Brachythecium rutabulum* on elder in North-West Wood. Scarce in Middlesex.

AMBLYSTEGIACEAE

Amblystegium serpens. Widespread on ground and tree bases.

Leptodictyum riparium (*Amblystegium riparium*). Sparsely in damp ditch in North-West Wood.

Drepanocladus aduncus. On muddy ground in wetland.

Calliergonella cuspidata (*Calliergon cuspidatum*). In Heather Pen among *Calluna*, March 1998.

Homalothecium sericeum. On concrete and tree-base in North-West Wood.

BRACHYTHECIACEAE

Brachythecium albicans. Widespread.

Brachythecium rutabulum. Common.

Brachythecium velutinum. On tree-base in North-West Wood, May 1997.

Scleropodium purum (*Pseudoscleropodium purum*). Scarce. Occasional in Heather Pen and in rough grass.

Rhynchostegium confertum. Frequent on ground and tree-bases.

Eurhynchium praelongum. Frequent on ground and tree-bases.

HYPNACEAE

Hypnum cupressiforme. Occasional.

Hypnum jutlandicum. A heathland moss, associated with *Calluna*.

LIVERWORTS

CEPHALOZIELLACEAE

Cephaloziella divaricata. Among small mosses under *Calluna*.

LOPHOZIACEAE

Lophozia bicrenata. Rare — only recorded site in Middlesex. Among small mosses under *Calluna*.

GEOCALYCACEAE

Lophocolea bidentata. On bank of damp ditch in North-West Wood.

Lophocolea heterophylla. On bank of damp ditch in North-West Wood.

ANEURACEAE

Aneura pinguis. On muddy ground in wetland, October 1997.

LUNULARIACEAE

Lunularia cruciata. In stream-bed by River Crane.

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References

BLOCKEEL, T.L. and LONG, D.G. 1998. *A check-list and census catalogue of British and Irish bryophytes*. British Bryological Society.

HOLT, M. 1998. The natural history of Hounslow Heath Local Nature Reserve — vascular plants. *Lond. Nat.* **77**: 65–72.

HUDSON, W. 1762. *Flora Anglica*. London.

KENT, D.H. In press. Supplement to *The historical flora of Middlesex*. The Ray Society, London.

RICHARDS, P.W.M. 1928. Ecological notes on the bryophytes of Middlesex. *J.Ecol.* **16**: 268–300.

ROTHERO, G.P. 1999. Musci. *In* New vice-county records and amendments to the census catalogue. *Bull. Br. bryol. Soc.* **74**: 97.

WILTSHIRE, E. and ELLIS, L.T. 1995. John Benbow (1821–1908) and the bryophytes of north-west Middlesex. *Lond. Nat.* **74**: 21–53.

Studies on the vegetation succession at Brockham lime kilns, Box Hill

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Abstract

The vegetation recolonizing chalk workings at Brockham lime kilns, Box Hill, Surrey was surveyed during summer 1998. Twelve transects were established and percentage cover values recorded for all vascular plants in five replicate metre-square plots per transect. Habitats ranged from loose, bare scree through chalk grassland to semi-mature woodland. Detrended Correspondence Analysis showed two distinct community types, woodland and open areas. The open areas were further subdivided into scree and chalk grassland. National Vegetation Classifications were derived for each habitat, with the open areas being identified as chalk grassland (CG2 or CG3) and the woodlands being chalk scrub (W21), though the fits were generally rather poor reflecting the anthropogenic nature of the site.

Introduction

Brockham lime kilns is a disused industrial site on the southern foot of Box Hill. The site used to consist of chalk quarries linked to two sets of lime kilns by a narrow-gauge railway, but has been abandoned since the 1930s. This industry left large areas of bare chalk and chalk rubble, which has subsequently undergone natural recolonization with calcicole flora. The eastern end of the complex is dominated by a landfill site filling up the disused quarry, although the lime kilns (including a uniquely well-preserved Bessel kiln) may still be seen. The western end of the site is now a local nature reserve, managed by Surrey County Council, and is the focus of the research described below.

Apart from the industrial archaeological interest of the site, it is noteworthy for the variety of successional stages present in its flora, which range from bare scree to young woodland. These contrast sharply with the mature yew *Taxus baccata* woodland which covers much of the southern face of Box Hill and surrounds the quarried areas. The quarried area certainly contains a higher species richness than these dense stands of yew, which may be assumed to correlate with higher species richness of other life forms, although Ozanne et al. (1997) note that gymnosperm monocultures can have remarkably high diversity of canopy arthropods.

The conservation interest of disused quarries has been reported previously (Davis and Jones 1978, Usher 1979, Ursic et al. 1997), but so far there have been no published records of attempts to fit these post-industrial communities into the National Vegetation Classification system (Rodwell 1991, 1992). The work described below reports a floral survey of various habitat types within Brockham lime kilns, some exploratory analyses of these data, and explores how well the communities of the anthropogenic habitat fit into the NVC scheme.

Methods

The research was undertaken within the Brockham lime kilns nature reserve (Grid reference TQ182511) during summer 1998. Twelve transects (each five metres long) were defined, each being located by reference to local conspicuous landmarks, without any permanent marking system being installed. These twelve transects covered all of the major habitat types within the quarry (loose scree, stabilized scree, chalk grassland, scrub woodland and semi-mature woodland). Each metre along each transect the percentage cover of all vascular plants was estimated in a one-metre-square quadrat. Where tree branches hung vertically above a quadrat, the appropriate tree species was recorded as having 100 per cent cover (which was reduced pro rata if only a portion of the quadrat was overhung). Multiple layers within the canopy meant that some quadrats were recorded as having substantially greater than 100 per cent cover. Summary site descriptions are given in Table 1.

Nomenclature follows Stace (1997).

TABLE 1. Summary description of each transect.

Transects 1 and 2: Kiln waste in front of the main kilns by visitor noticeboard, now covered in semi-mature woodland dominated by willow and birch. Classified in this work as woodland. NVC classification W21d (*Crataegus monogyna/Hedera helix* scrub, *Viburnum lantana* subcommunity), with goodness of fit coefficients of 30.9% and 32.1% respectively.

Transects 3 and 4: Spoil banks to the left of the entrance to the quarry proper, with orchids, calcicoles and young scrub. Classified in this work as a scree site. NVC communities CG2a (*Festuca ovina/Avenula pratensis* grassland subcommunity *Cirsium acaule/Asperula cynanchica*) and CG3 (*Bromus erectus* grassland), with goodness of fit coefficients of 27.5% and 14.2% respectively.

Transect 5: Loose scree at the extreme west end of the quarry. NVC classification CG7c (Breckland rabbit-grazed chalk grassland!), with goodness of fit coefficient of 15.7%.

Transects 6 and 7: Chalk grassland in the middle of the quarry. NVC classifications CG2a as for transects 3 and 4, with goodness of fit coefficients of 21.4% and 25.6% respectively.

Transects 8 and 9: Dense secondary woodland by disused railway track in quarry. NVC classifications W21d (as for transects 1 and 2), with goodness of fit coefficients of 30.9% and 32.1% respectively.

Transect 10: Semi-stable scree at extreme east end of the quarry. NVC classification W21 with a goodness of fit coefficient of 31.3%.

Transects 11 and 12: Scrub woodland with orchids, at east end of quarry. NVC classifications W21d and W8d (*Fraxinus excelsior/Acer campestre/Mercurialis perennis* woodland, *Hedera helix* subcommunity), with goodness of fit coefficients of 24.1% and 23.1% respectively.

Software used for data analysis and ordination were SPSS for Windows, PC-Ord (MjM Software design 1995) and VESPAN III (Malloch 1997*a*), while MATCH II (Malloch 1997*b*) was used to fit community data into the NVC scheme. The ordination chosen was Detrended Correspondence Analysis (DCA), implemented by the DECORANA algorithm within PC-ORD. This ordination was chosen as being especially suitable for resolving successional patterns in ecological data (Hill 1979). It should be noted that although this is a popular and widely trusted algorithm, the numerical scores it produces are best regarded as unit-free indices whose ordering reveals patterns within data but whose actual values are meaningless. DCA ordination was performed on mean percentage cover values for each transect, effectively reducing sixty observations down to twelve, and only used plants whose mean percentage cover was >1 per cent in at least one transect. These exclusions facilitated interpretation by reducing clutter within ordination diagrams and avoiding the random noise associated with infrequent species.

Results

A total of fifty-six plant species was recorded in the quadrats. The plant species recorded in each habitat are given in Table 2 (mean percentage cover of dominant species) and Table 3 (percentage of quadrats containing each of the remaining species). Table 4 gives diversity and species richness values for the habitats. DCA ordination of these data are shown in Figure 1, which shows the data to consist of two discrete habitat clusters. The negative end of the first axis is occupied by the woodland sites, while the positive end of this axis contains the open habitats (grassland and scree). The second axis refines the ordination of the open habitats, with loose scree at the negative end (lower right-hand corner of the figure), stabilized scree in the middle and calcareous grassland at the positive end (top right-hand corner).

NVC-suggested categories are shown in Table 1, along with goodness of fit indices. These show that the open areas generally classify as chalk grassland (CG2; *Festuca ovina/Avenula pratensis* grassland, CG2a *Cirsium acaule/Asperula cynanchica* subcommunity, or CG3 *Bromus erectus* grassland) or calcareous scrub woodland (W21 – *Crataegus monogyna/Hedera helix* scrub). The barest scree site (site 5) was suggested as being a breckland grassland (CG7c), but with an extremely poor fit of 15 per cent, showing that this habitat did not classify satisfactorily.

TABLE 2. Mean percentage cover (by habitat) of the commoner plant species in Brockham quarry (defined as those with a mean % cover >1% in at least one habitat), along with their loadings in a DCA ordination.

	Habitat			**DCA loadings**	
Species	**Woods**	**Scree**	**Grassland**	**Axis 1**	**Axis 2**
Acer pseudoplatanus	27	0	0	−18	21
Betula pendula	50	2	5	72	163
Buddleja davidii	0	3	0	346	−9
Cirsium acaule	0	0	7	393	378
Clematis vitalba	5	0	0	−64	139
Cornus sanguinea	27	11	3	188	172
Cotoneaster horizontalis	0	2	0	346	−12
Crataegus monogyna	31	2	4	73	270
Fragaria vesicaria	4	0	0	273	92
Fraxinus excelsior	4	0	0	74	108
Galium mollugo	0	2	0	312	47
Hedera helix	11	0	0	80	154
Hieracium maculatum	0	12	2	345	202
Lotus corniculatus	0	0	11	394	390
Melica uniflora	7	0	2	144	194
Mercurialis perennis	18	0	0	−74	88
Moss	14	0	0	—	—
Origanum vulgare	0	3	3	342	289
Pilosella officinarum	0	0	2	377	351
Polygala vulgaris	0	0	1	360	323
Poterium sanguisorba	0	2	6	356	332
Prunella vulgaris	0	0	1	412	403
Ranunculus parviflorus	0	0	1	387	374
Rosa canina	0	1	0	310	91
Rubus fruticosus	1	1	0	295	143
Salix caprea	32	0	0	47	185
Tamus communis	3	1	0	79	154
Taxus baccata	2	0	0	35	1
Teucrium scorodonia	0	1	0	305	23
Viburnum opulus	6	0	0	27	348

TABLE 3. Frequency of occurrence of minor species, expressed as the per cent of quadrats in which the species was found.

		Habitat	
Species	**Woodland**	**Scree**	**Grassland**
Acer campestre	17	10	10
Bellis perennis	0	10	40
Blackstonia perfoliata	0	5	0
Centaurium erythraea	0	0	30
Corylus avellana	4	0	0
Dactylorhiza fuchsii	13	20	50
Digitalis purpurea	4	0	0
Echium vulgare	0	10	0
Epilobium montanum	10	20	0
Fagus sylvatica	4	0	0
Geum urbanum	4	0	0
Heracleum sphondylium	4	0	0
Hypericum perforatum	4	45	20
Lamium album	17	0	0
Ligustrum vulgare	17	15	0
Linum catharticum	0	0	50
Listera ovata	33	15	10
Plantago lanceolata	0	10	0
Quercus sp.	0	5	0
Scrophularia nodosa	4	15	40
Senecio jacobaea	0	5	0
Sonchus oleraceus	0	5	0
Sorbus aria	4	20	0
Thymus praecox	0	5	0
Trifolium sp.	0	10	0
Viola sp.	13	0	0

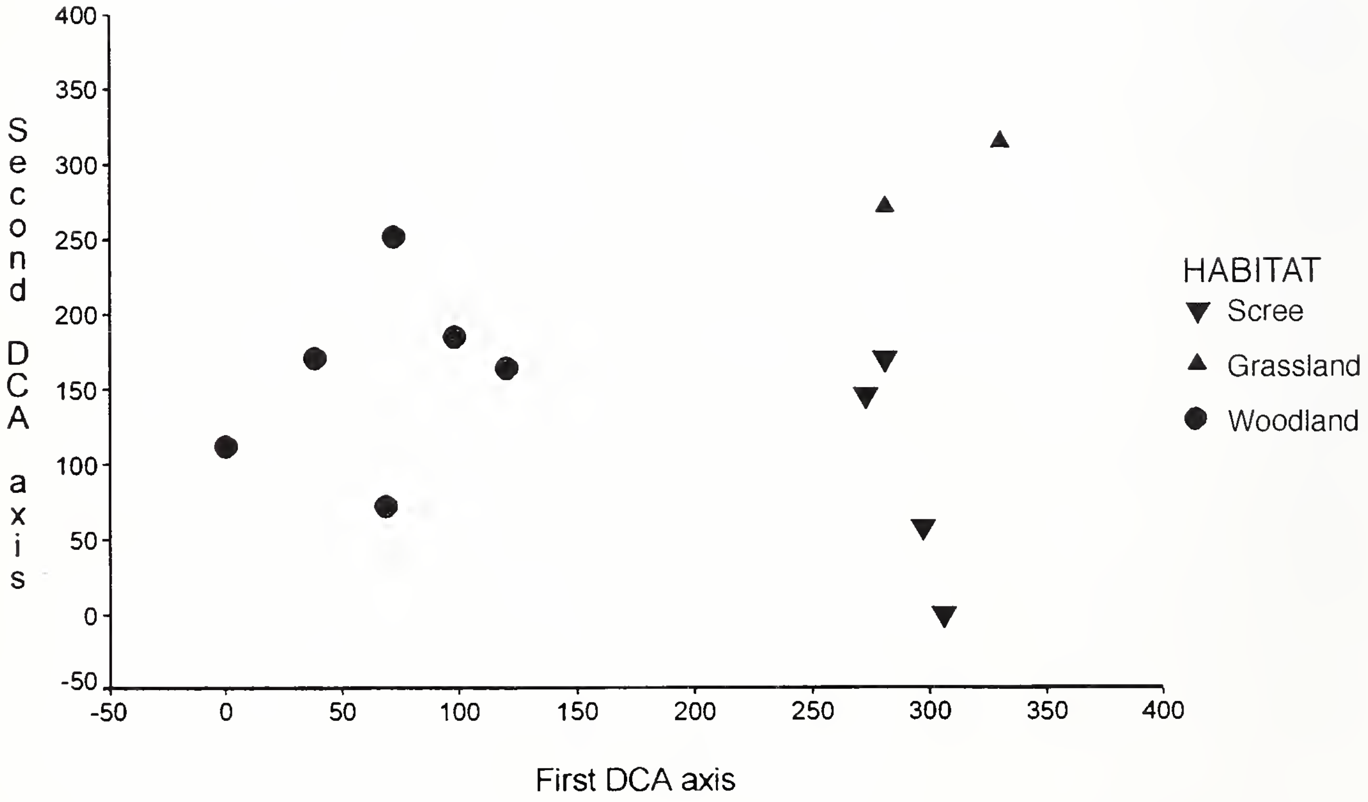

FIGURE 1. DCA ordination diagram of the Brockham lime kiln vegetation data. Note that the axes are scaled in arbitrary units.

TABLE 4. Summary diversity indices for the three habitats.

	Woodland	**Scree**	**Grassland**
Species richness	39	40	23
Shannon index	2.47	2.76	2.57
Equitability	0.67	0.75	0.82

Discussion

The plant species list given here should not be regarded as definitive, as the aim of the exercise was to sample major communities at the site rather than to compile exhaustive lists. It is known that many more species of vascular plant occur at the site but were not found in a transect (one example being the fly orchid *Ophrys insectifera*). In many cases grasses could not be identified confidently to species, and were simply recorded as 'grass'. The plants recorded were typical of disturbed chalky areas, with the most notable species being the hawkweed *Hieracium maculatum* agg. whose purple-blotched leaves were ubiquitous on the disturbed areas but totally absent from surrounding stable habitats. The aliens *Buddleja davidii* and *Cotoneaster horizontalis* were often conspicuous elements of the scree flora. None of the quadrats sampled the local climax habitat type (dense yew *Taxus baccata* woodland), although young yews were recorded in the older woodland areas.

DCA showed a sharp dichotomy in the data between the woodland habitats and open areas (Figure 1). The first DCA axis corresponded to this woodland/open-habitat division, with the negative (left-hand) end of the axis containing the wooded sites. Because of this, the loading given to each species on the first DCA axis can be used as an index of its successional position, with low values implying late successional status, while high values are associated with early successional species. These loadings are shown in Table 2, and show late successional species typical of the local woodlands (yew *Taxus baccata,* wild clematis *Clematis vitalba,* sycamore *Acer pseudoplatanus,* guelder rose *Viburnum opulus* and dog's mercury *Mercurialis perennis*) to have low or negative values, while high loadings are associated with plants of bare/disturbed areas (e.g., bird's-foot trefoil *Lotus corniculatus,* stemless thistle *Cirsium acaule*). The second DCA axis defined a gradient within the bare sites, with open scree at the negative end and stable grassland at the positive end. Consequently, species with negative loadings on the second axis should be associated with scree slopes. This pattern also holds up; the negative loadings on axis 2 are those of buddleia *Buddleja davidii* and cotoneaster *Cotoneaster horizontalis,* both species of the unstable scree.

The NVC classifications generally made good sense in view of the site's geology and history. The grasslands were predominantly identified as CG2 (*Festuca ovina/Avenula pratensis* grassland), which is a species association of thin calcareous soils on warm, dry sites which Rodwell (1992) notes as being widespread on the South Downs, and may colonize disused quarries. Similarly, the later successional stages were almost invariably classified as W21d — *Crataegus monogyna/Hedera helix* scrub, *Viburnum lantana* subcommunity. This corresponds to the chalk scrub association of older authors, which is well known as the sub-climax community arising from invasion of chalk rubble, especially in the south. Despite being plausible, the numerical values of the fits to NVC categories generated by MATCH2 (Malloch 1997*b*) are poor, never better than 32 per cent. This reflects species omissions (especially grasses, which are obviously crucial in identifying grassland habitats), and also the unstable/successional nature of the ecosystems which are changing from open grassy areas to dense woodlands.

As is often the case with a post-industrial site, different areas were abandoned at different times, leading to a mosaic of different-aged habitats. This sometimes makes it possible to infer the successional sequence through observation of a chronosequence (Hall (1957) on mine spoil, Lee and Greenwood (1976) on lime waste, Roberts et al. (1981) on china clay, Greenslade and Majer (1993) on bauxite waste, Shaw (1992) on PFA, and Usher (1979) in a chalk quarry), although obtaining precise dates of abandonment for derelict sites is always problematic, requiring good documentation or interviews with surviving workers. In the case of Brockham lime kilns it would be over simplistic to interpret the results in terms simply of recolonization patterns since the quarries have been subject to almost continual disturbance since the cessation of industrial activities. This disturbance has taken two forms: natural disturbance (such as that resulting from the instability of scree slopes), and anthropogenic damage such as that caused by mountain bikes, fire lighting, etc. The first ordination axis (Figure 1) really separated disturbed areas from those undisturbed enough to develop woodland cover, and while the wooded sites are clearly long abandoned there is no certainty that the open areas are actually any younger. Similarly, it is tempting but oversimplistic to view the second DCA axis as a successional continuum from bare scree to stable grassland. In reality steep scree is unlikely to produce chalk grassland due to its instability, and a more parsimonious interpretation of the second axis would be the difference between loose scree and stable grassland.

The results presented above should not be seen as a final or definitive description of the quarry community. A better approach is to regard them as a baseline survey, on which further lines of research can build. This future work could include monitoring of parallel successional changes (such as studies on soil properties or soil fauna), and regular revisiting of the site to study long-term changes within the quarry.

References

DAVIS, B.N.K. and JONES, P. E. 1978. The ground arthropods of some chalk and limestone quarries in England. *J. Biogeogr.* **5**: 159–171.

GREENSLADE, P. and MAJER, J.D. 1993. Recolonisation of Collembola of rehabilitated bauxite mines in Western Australia. *Aust. J. Ecol.* **18**: 385–394.

HALL, I.G. 1957. The ecology of disused pit heaps in England. *J. Ecol.* **45**: 689–720.

HILL, M.O. 1979. *DECORANA: a FORTRAN program for detrended correspondence analysis.* Section of Ecology and Systematics, Cornell University, Ithaca, New York.

LEE, J.A. and GREENWOOD, B. 1976. The colonisation by plants of calcareous industrial waste from the salt and alkali industry in Cheshire, England. *Biol. Conserv.* **10**: 131–149.

MALLOCH, A.J.C. 1997*a*. *VESPAN III. Routines for vegetation analysis and species distributions for WINDOWS NT and WINDOWS 95.* University of Lancaster.

MALLOCH. A.J.C. 1997*b*. *MATCH II. A computer programme to aid the assignment of vegetation data to the communities and subcommunities of the National Vegetation Classification.* University of Lancaster.

MJM SOFTWARE DESIGN. 1995. *Pc Ord: multivariate analyses of environmental data, version 2.0.* Oregon: MjM Software Design.

OZANNE, C.M.P., FOGGO, A., HAMBLER, C. and SPEIGHT, M.R. 1997. The significance of edge effects in the management of forests for invertebrate biodiversity. *In* Stork, N.E., Adis, J. and Didham, R. (eds), *Canopy arthropods*: 534–550. Chapman and Hall, London.

ROBERTS, R.D., MARRS, R.H., SKEFFINGTON, R.A. and BRADSHAW, A.D. 1981. Ecosystem development on naturally colonised china clay wastes. 1. Vegetation changes and overall accumulation of organic matter and nutrients. *J. Ecol.* **69**: 153–161.

RODWELL, J.S. 1991. *British plant communities* **1**. *Woodlands and scrub.* Cambridge University Press.

RODWELL, J.S. 1992. *British plant communities* **3**. *Grasslands and montane communities.* Cambridge University Press.

SHAW, P.J.A. 1992. A preliminary study of successional changes in vegetation and soil development on unamended fly ash (PFA) in southern England. *J. appl. Ecol.* **29**: 728–736.

STACE, C. 1997. *New flora of the British Isles.* Ed. 2. Cambridge University Press.

URSIC, K.A., KENKEL, N.C. and LARSON, D.W. 1997. Revegetation dynamics of cliff faces in abandoned quarries. *J. appl. Ecol.* **34**: 289–303.

USHER, M.B. 1979. Natural community of plants and animals in disused quarries. *J. envir. Management* **8**: 223–236.

A Latin square investigation of management treatments on neutral hay meadow grasslands

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Abstract

The effects on plant species richness of three management treatments, hay harvesting, flail cutting and no cutting, were compared using a Latin square layout on neutral London Clay grasslands at Fryent Country Park, Middlesex from 1989 to 1994. Hay harvesting was found to be the most effective of the three treatments for maximizing the plant species richness. Flail cutting was almost as effective, whilst no cutting resulted in the lowest species richness. The most marked change in species richness occurred in the first, or first two years, following a change of management. When management treatments were reversed, or changed, the species richness of grasslands which had previously been uncut, recovered if flail cutting or hay harvesting were restored.

Introduction

Several grassland management treatments are used by local authorities and other land managers to maximize the wildlife, recreational or agricultural use of their land. Where grazing is not practised, hay harvesting is an alternative. As discussed by Parr and Way (1988) it has been widely considered that removal of the cut material maximizes the floristic diversity of the sward. However, hay cutting is not always feasible. An alternative is flail cutting in which the cutting action is effectively the same as for hay cutting but with the cut material left on the ground. Flail cutting does not yield a crop and some authors have argued that it reduces the floristic diversity of the sward due to nutrient enrichment from the decomposing material. Research work has suggested that the reduction in diversity was more likely to be due to smothering by unremoved vegetation (Parr and Way 1988). A third option, no cutting, saves time and machinery costs but may result in changes to the grassland and succession to other communities. Recently, the potential for using set-aside and associated policies to promote wildlife conservation has been discussed (Lane 1995). Since several of these schemes involve short-term changes of management treatment, it was opportune to consider the effects of reversing and changing treatments at short intervals.

The object of this investigation was to compare the effect on species richness (the number of species per unit area) of three treatments: hay harvesting, flail cutting with the cut material left on the ground, and no cutting, on a neutral grassland community which had been previously managed as a hay meadow. The effect of changing or reversing treatments was also investigated.

Materials and methods

The study site, Fryent Country Park, covers an area of approximately 103 hectares about fifteen kilometres north-west of central London. The Park is located in the London Borough of Brent and is owned by Brent Council. Despite being surrounded by suburbia and bisected by Fryent Way, the Park is a Local Nature Reserve and managed for nature conservation, public recreation, landscape heritage, and as a farm with woodland (Williams and Northcroft 1992). Its altitude varies from about 40–80 metres above sea level (OD). Geologically, the hay meadows are on London Clay (Eocene).

The experiment was established in Warrens/Blacklandes field, one of sixteen hay meadows on the east side of the Country Park (TQ198878). The flora of the field appeared to be typical of that of the surrounding neutral Mesotrophic Grasslands 1 (MG1). The soil in Warrens field had a pH of 6.9. The plot was situated away from the hedgerow/field edges and cross-field footpaths. Hay cutting had been practiced in Warrens field since 1983 and during the investigation, except in 1987 when the field was flail cut and in 1993 when approximately half of the field was flail cut. Hay cutting appeared to have been practised for some years prior to 1983, though there was evidence of cattle grazing during the late 1970s.

For the experiment, a Latin square design was used as comparison of different grassland treatments suggested the use of a technique based on analysis of variance. Latin square designs can be used to analyse the effects of the several treatments under investigation; and of the errors associated with possible latitudinal and longitudinal effects across the experimental plot. In effect the design enables the partitioning of sums of squares due to the treatments and of those due to the field plot gradients. The Latin square has an equal number of rows and columns representing the number of different treatments and constructed so that a particular treatment occurs once only in each row and column. Analysis of Latin square experimental designs without replication is well documented (see for example Fowler and Cohen 1990). Small modifications to the standard analysis can be made when replicates are available which give greater power to the tests of the main effects (treatments, rows and columns). In this analysis there were three treatments, three rows, three columns and twenty replicates, i.e., a total of 180 counts per analysis. The 'error' term for testing each 'main effect' was the 'main effect' × replicate. For example, the treatment × replicate interaction was used to assess treatments. All other effects (including replicates) were tested against the overall error. Validity of the analyses were checked using both residual plots and Filliben correlation coefficient to assess normality (Filliben 1975). Once a main effect was found to be statistically significant, Tukey's Test was applied to determine which of the three pairs of treatments were different from which (see Fowler and Cohen 1990). Tukey's critical value, T, was calculated with the aid of Tukey test tables. If the differences between the averages of any two of the three treatments exceeded Tukey's critical value then the difference was statistically significant.

Three replicates of each of the three treatments (A – hay harvesting; B – flail cutting; C – no cutting) were arranged in a grid of nine units (or 'plots'), of total area of 27 m × 27 m (729 m^2). Each of the nine units was of 9 m × 9 m (81 m^2) area and consisted of a peripheral buffer zone of width 2 m and an internal area of 5 m × 5 m. The management of the buffer zone was the same as for each internal area. The internal area allowed for a grid of 10 × 10 sub-squares of 0.25 m^2. Individual sub-squares were located by the use of graduated lines which could be moved horizontally and vertically through the unit. A 0.25 m^2 quadrat was used to define the boundary of each sub-square. To avoid excessive trampling, the quadrats were surveyed row by row in numerical sequence from 00 (lower left) to 99 (top right).

The sampling strategy was based on that described by Greig-Smith (1983). In the first year twenty quadrats were selected in each unit, using random numbers from Kershaw and Looney (1985). In the second year the same twenty quadrats were resurveyed and a further twenty quadrats selected at random even if they included one or more from the previous year's sample of quadrats. In the third year the twenty second-year quadrats were resurveyed, plus a further twenty selected at random; and so on. This was to avoid the difficulty with fixed samples of quadrats if several successive changes at one point were correlated, i.e., to avoid 'autocorrelation' (Usher 1991). Thus the second sample of quadrats, recorded at the end of the first period, could be used to estimate changes in the second period; and the third sample of quadrats in the third period. If random number tables produced one or more duplicates within any sample of twenty, the duplicate of the pair was not used but a further number was selected until a sample of twenty different quadrats in every 100 had been selected.

Records were made of each species of plant whose shoots occurred within the quadrats. Species richness was estimated as the number of species per quadrat, or as the average number of species over the quadrats in each sample. The frequency (Curtis and McIntosh 1950) was estimated from the percentage of quadrats in which a species occurred.

Management treatments were applied to the units after the recording had been completed for that year. Usually the hay harvesting and flail cutting treatments were undertaken at approximately the same time as a contractor undertook cutting in adjacent fields, but within as short a period as possible: between 9–16 August 1989, on 13 August 1990, 7 August 1991, 29–30 July 1992, and 2–15 August 1993.

The results obtained in each year were compared with the treatment applied during the previous twelve months. Species richness was estimated for all species combined, and for four constituent groups and sub-groups of: grasses, all forbs, forbs excluding annual legumes, and annual legumes. Data for individual species were compared, but were of less use for statistical analysis than the grouped data as some species had low or zero frequencies and localized distributions within the Latin square. Indeed, some of the grouped data were not immune from these problems.

From the summer of 1991 the treatments were changed by the retention of one each of the three original units of each treatment trio, but with one each of the remaining units assigned to the other two treatments. Effectively, the three hay-harvested treatments were randomly assigned to A, B or C:

1989			**1989–91**			**1991–4**		
A	A	A	C	B	A	C	A	B
A	A	A	A	C	B	A	B	C
A	A	A	B	A	C	B	C	A

The grouped data were analysed after taking a square root transformation using analysis of variance.

Nomenclature follows Stace (1991).

Results

Results are given for the analysis of variance for the Latin square experiment (1989–91); for the years following the rearrangement of treatments (1991–4), and for the effect on individual species. Species richness refers to a quadrat size of 0.25 m^2.

Baseline reproducibility

No significant interactions or diferences between replicates were found for any analysis. All residual plots and normality checks were satisfactory. Therefore it was possible to describe the differences between the treatments using means.

In the baseline year, 1989, all experimental units received the same hay harvesting treatment as in 1988. As shown in Table 1, no significant differences could be detected between the experimental units that would receive treatments A, B and C in the following years for all species combined and for grasses. However treatment C experimental units yielded a significantly lower mean for both forbs and forbs excluding annual legumes.

TABLE 1. Summary of the means and the analysis of variance of species richness per 0.25 m^2 for the baseline year 1989 at Fryent Country Park. Means were compared pairwise using Tukey's LSD.

		Treatment means			**Tukey's LSD**		
	Significance of treatment comparison	**A** (hay cutting & harvesting)	**B** (flail cutting)	**C** (no cutting)	**A** vs **B**	**B** vs **C**	**C** vs **A**
All species	ns	7.717	8.020	7.447	ns	ns	ns
Grasses	ns	5.551	5.655	5.612	ns	ns	ns
All forbs	**	2.105	2.277	1.740	ns	*	ns
Forbs excluding annual legumes	***	2.094	2.217	1.700	ns	*	*
Annual legumes		0	0.004	0.003		Insufficient data	

(ns: not significant ($P>0.05$); *: $P<0.05$; **: $P = 0.01$; and ***: $P<0.001$)

Three treatments applied to a hay meadow

Results were available for six time sets (Table 2): 1990p, change 1989–1990p, 1990n, 1991p, change 1990n–1991p, and 1991n, where 'n' denotes a new set of quadrats and 'p' denotes the same quadrat set as that denoted by 'n' in the previous year.

Hay harvesting once a year (treatment A) was found to be the best of the three treatments for maximizing the plant species richness (Table 2). This was so for all species combined, grasses, forbs, forbs excluding annual legumes, and for annual legumes. Flail cutting once a year (treatment B) was almost as effective as hay harvesting for maximizing the plant species richness (Table 2). This was so for all species combined, grasses, forbs, and for annual legumes. The species richness of forbs excluding annual legumes declined under the flail-cutting treatment.

No cutting (treatment C) resulted in the lowest species richness of the three treatments, for all species combined and for each of the four constituent groups. For all species combined the decline in species richness per 0.25 m^2 was from an average of 7.5 species in 1989, to 5.3 in the first year, followed by a decline to 3.7 at the end of the second year. The difference between no cutting and the other two treatments was greater than the differences between hay harvesting and flail cutting (Table 2). The differences between the two-cutting treatments as compared with the no-cutting treatment were broadly similar for the constituent sub-groups of grasses, all forbs, all forbs less annual legumes, and annual legumes.

TABLE 2. Summary of the means and the analysis of variance of species richness per 0.25 m^2 for the six year sets 1990p, change 1989–1990p, 1990n, 1991p, change 1990n–1991p, 1991n, where 'n' denotes a new set of quadrats and 'p' denotes the same quadrat set as that denoted by 'n' in the previous year at Fryent Country Park. Means were compared pairwise using Tukey's LSD.

		Treatment means			**Tukey's LSD**		
Year contrast	Significance of treatment comparison	**A** (hay cutting & harvesting)	**B** (flail cutting)	**C** (no cutting)	**A** vs **B**	**B** vs **C**	**C** vs **A**
All species							
1990p	***	7.640	6.828	4.964	ns	*	*
1990n	***	7.420	6.503	5.157	*	*	*
1989-1990p	***	0	0.048	0.251	*	*	*
1991p	***	7.890	7.204	3.501	ns	*	*
1991n	***	8.111	7.404	3.706	*	*	*
1990n-1991p	***	0.007	0.018	0.159	ns	*	*
Grasses							
1990p	***	3.775	3.471	2.762	ns	*	*
1990n	***	3.717	3.309	2.817	ns	*	*
1989-1990p	nd	0.170	0.265	0.500			
1991p	***	3.924	3.546	1.737	ns	*	*
1991n	***	3.849	3.667	1.814	ns	*	*
1990n-1991p	***	0.003	0.004	0.130	ns	*	*
All forbs							
1990p	***	3.976	3.291	2.079	*	*	*
1990n	***	3.629	3.119	2.250	*	*	*
1989-1990p	***	0.243	0.093	0.015	*	*	*
1991p	***	3.905	3.591	1.603	ns	*	*
1991n	nd	4.170	3.683	1.782			
1990n-1991p	***	0.005	0.017	0.055	ns	*	*
Forbs excluding annual legumes							
1990p	***	2.223	1.990	1.162	ns	*	*
1990n	***	2.120	1.855	1.182	ns	*	*
1989-1990p	*	0.002	0.006	0.051	ns	ns	*
1991p	***	1.891	1.568	1.030	ns	*	*
1991n	***	2.108	1.740	1.086	ns	*	*
1990n-1991p	ns	0.007	0.012	0.005	ns	ns	ns
Annual legumes							
1990p	***	1.707	1.166	0.661	ns	*	*
1990n	***	1.440	1.098	0.772	*	*	*
1989-1990p	***	1.467	1.026	0.583	*	*	*
1991p	nd	1.920	1.820	0.303			
1991n	***	2.007	1.847	0.363	ns	*	*
1990-1991p	***	0.034	0.091	0.107	ns	*	*

(nd: not done – insufficient data; ns: not significant ($P>0.05$); *: $P<0.05$; **: $P = 0.01$; and ***: $P<0.001$)

Continuation, change and reversal of management treatments

During the Latin square experiment it was noted that most of the change in species richness occurred in the first, or first two years, following a change of management, whilst little change was apparent in the third year (Figure 1). This was true for all species combined, and for the constituent classes of grasses, and in general for the forb sub-groups. During the second part of the investigation, treatments were continued, changed or reversed, and although these results were not subjected to analysis of variance, the changes in species richness are shown graphically in Figure 2. As before, the species richness per 0.25 m^2 was responsive to the treatment that had been applied during the most recent year or two years.

This appeared to be independent of the management treatment applied to the grassland earlier in the experiment. In general where the earlier treatments were left unchanged, there was little change in species richness in the third or subsequent years following the start of the investigation. There was an anomaly in 1993 when the flail cutting resulted in a species richness approximately midway between that of hay harvesting and no cutting (Figure 1).

Where management treatments were reversed, or changed, the species richness of grasslands which had not been cut, recovered if flail cutting or hay harvesting was restored. Generally, grasslands managed by hay harvesting had the highest species richness, flail-cut grasslands had a species richness ranging from almost as high to lower than that of hay harvesting, whilst no cutting resulted in the lowest species richness. The net change in species richness after three years was for the largest declines to occur in units changing from hay-harvesting to no-cutting treatments; and the largest increases in species richness for the no-cutting to hay-harvesting treatments. For the constituent sub-groups the net changes in species richness after three years were broadly similar to that for all species combined, albeit an overall decline in annual legumes in all units during 1991–3. For grasses and for all forbs the species richness declined in the flail-cutting to no-cutting, and hay-harvesting to no-cutting units, and increased in the no-cutting to flail-cutting and no-cutting to hay-harvesting units.

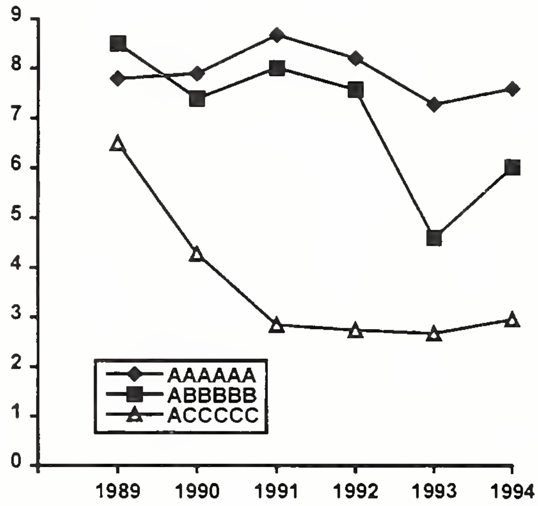

FIGURE 1. Species richness per $0.25m^2$ for all plant species combined in grassland with three management treatments, Warrens field, Fryent Country Park, 1989–94. A – hay cutting and harvesting; B – flail cutting; C – no cutting. Data are based on the average of all quadrats.

Species

Thirteen species were frequent enough to indicate their response to the management treatments. For ten species, the highest frequencies occurred under the hay-harvesting treatment and the lowest frequencies under the no-cutting treatment. *Ranunculus repens* creeping buttercup, *Vicia hirsuta* hairy tare, *Holcus lanatus* Yorkshire fog, *Poa trivialis* rough meadow-grass, *Bromus commutatus* meadow brome, and *Agrostis* spp. bent grasses were typical of this pattern, with the species having intermediate frequencies under the flail-cutting treatments. For *Ranunculus acris* meadow buttercup and *Vicia sativa* common vetch, the difference between the frequencies under the hay-harvesting and flail-cutting treatments was not great, while for *Trifolium pratense* red clover and *Lolium perenne* perennial rye-grass there was little difference between the frequencies for the flail-cutting and no-cutting treatments.

After three years of the no-cutting treatment some species declined to low frequencies, i.e., meadow buttercup mainly as seedlings under the *Arrhenatherum elatius* false oat-grass canopy, common vetch and Yorkshire fog, while other species were no longer recorded: creeping buttercup, red clover, hairy tare, perennial rye-grass, rough meadow-grass, meadow brome and bent grasses.

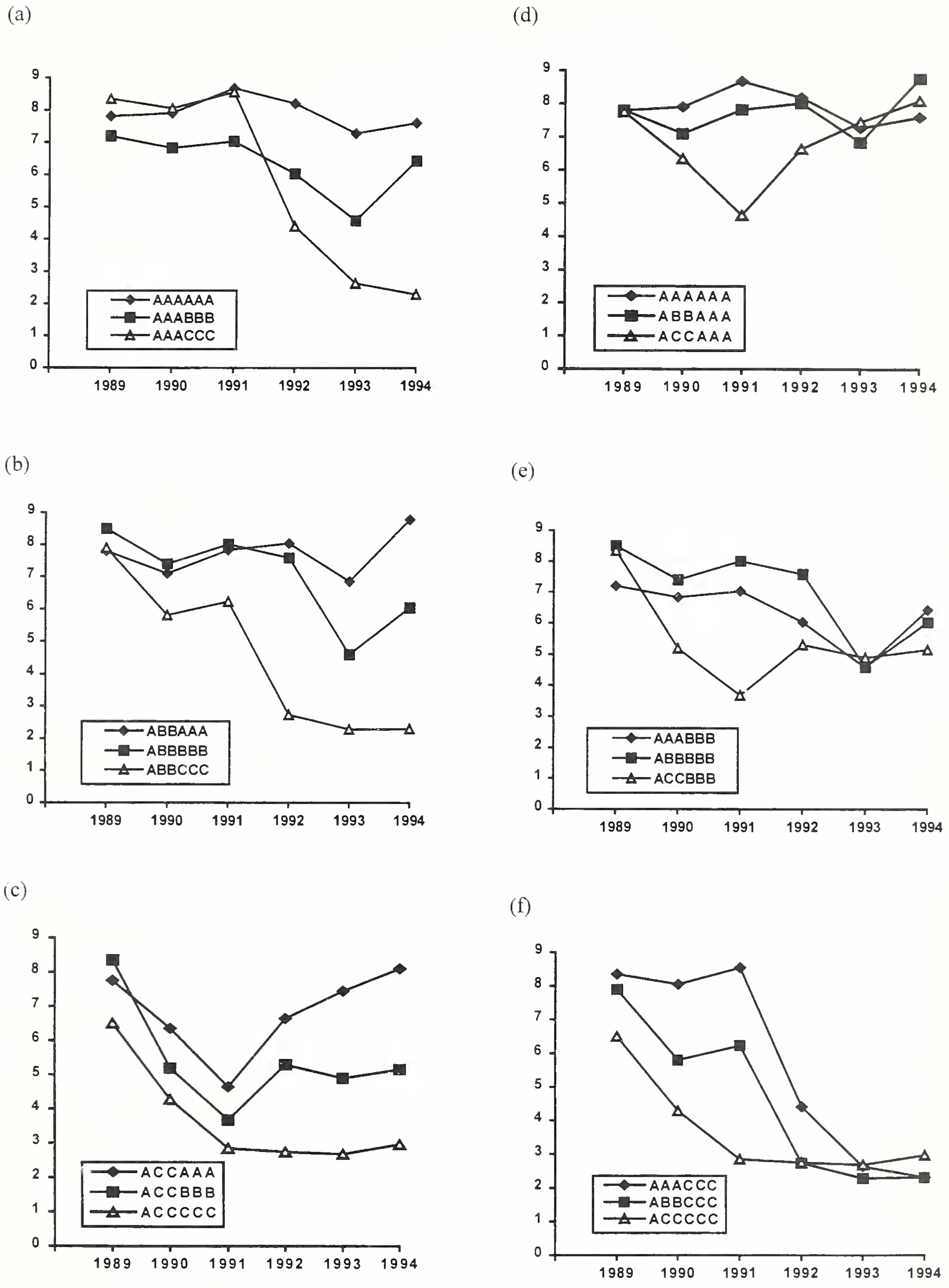

FIGURE 2. Species richness per $0.25m^2$ for all plant species combined in grassland at Fryent Country Park, 1989–94, with combinations of three management treatments over a six-year period: A – hay cutting and harvesting; B – flail cutting; C – no cutting. Data are based on the average of all quadrats. Three treatments applied to grasslands previously managed by (a) hay harvesting; (b) flail cutting; (c) no cutting treatments. The application of (d) hay harvesting; (e) flail cutting; (f) no cutting, to grassland previously managed by three treatments. The six-letter sequence within the key indicates the respective treatment applied each year.

Frequencies of some species increased when cutting resumed on grasslands which had not been cut for two years. *Elytrigia repens* couch and false oat-grass, did not appear to be affected by the treatment applied. False oat-grass had a high frequency (93 per cent) in the baseline year, while in 1992 it was recorded in all quadrats surveyed and thus it proved difficult to interpret any change in frequency. Only one species, *Cirsium arvense* creeping thistle, had higher frequencies under the no-cutting as compared with the two-cutting treatments.

Several species were affected by non-treatment effects, possibly environmental or successional. Perennial rye-grass declined in all treatments particularly during 1989–90. Meadow buttercup, Yorkshire fog and rough meadow-grass also declined during 1989–90 in all treatments. The annual legumes *Trifolium dubium* lesser trefoil, *Vicia hirsuta* hairy tare and *Vicia sativa* common vetch increased dramatically during the first year, and in general during the second year, though they declined towards the end of the investigation. These changes in frequency reflected a low species richness in the baseline year and, for the two *Vicia* species, absence as vegetative plants in that year.

The other species recorded during the investigation were infrequent and/or localized: *Cerastium fontanum* common mouse-ear, *Geranium dissectum* cut-leaved cranesbill, *Vicia tetrasperma* smooth tare, *Lathyrus pratensis* meadow vetchling, *Prunus spinosa* blackthorn, *Crataegus* × *macrocarpa* hybrid hawthorn, *Pyrus communis* pear, *Rumex acetosa* common sorrel, *Rumex crispus* curled dock, *Rumex sanquineus* wood dock, *Quercus robur* pedunculate oak, *Prunella vulgaris* selfheal, *Galium aparine* cleavers, *Tragopogon pratensis* goat's-beard, *Taraxacum officinale* dandelion, *Poa pratensis* smooth meadow-grass, *Dactylis glomerata* cocksfoot, *Bromus hordeaceus* soft-brome, *Hordeum secalinum* meadow barley, *Phleum bertolonii* smaller cat's-tail, *Alopecurus pratensis* meadow foxtail, and two mosses *Brachythecium rutabulum* and *Eurhynchium praelongum*.

Discussion

Cutting and harvesting the grassland once annually in summer maintained the species richness of the sward. It also provided a hay crop. Harvesting appeared to be a slightly better option than leaving the cut material on the ground. But, if resources or circumstances did not permit harvesting, flail cutting was an effective second choice. No cutting, however, caused a rapid decline in species richness and the frequency of the constituent species. These results agreed with the literature in that cutting, and/or grazing, retains species richness better than not cutting (e.g., Wells 1980). Parr and Way (1988), in an investigation of roadside vegetation, found that removal of cuttings led to an increase in vascular plant species richness, due mainly to an increase in herbs. This increase was probably associated with cutting, disturbance and scarification during harvesting, and from the alleviation of the smothering effect caused when cut vegetation is left on the ground. When uncut leaf litter, formed principally from the grasses, collapses at the end of the growing season, it accumulates as a mat at the base of the sward and may smother low-growing species by reducing light penetration at ground level (Carson and Pickett 1990, Wells 1980), and thus reducing photosynthesis, germination (Parr and Way 1988), and seedling establishment (Wesson and Wareing 1969).

Only a small proportion of the total nutrients in non-agricultural grasslands can be removed in any one year and that can be balanced by natural inputs (Wells 1980, Parr and Way 1988). Other literature has considered the effects of cutting and harvesting, in relation to the time of cutting (Oomes and Mooi 1981), competition, the opening of between-plant niche spaces (Wesson and Wareing 1969), and the effect of voles in uncut grasslands (Hansson 1977, Leutert 1983). Grime (1990) suggested that repeated defoliation was conducive to dense packing of individual plants. Historically, there is evidence (Garrett 1935, Bolton 1971 and 1976) that Middlesex grasslands were cut for hay in the summer and the aftermath grazed during the autumn, a treatment which would equate to two or more cuts per year. Although the economic, energy and environmental considerations of the treatments were outside the scope of this investigation, it was noted that if not harvested, the costs of collecting cuttings were substantial as compared with the costs of flail cutting only.

Parr and Way (1988) observed that false oat-grass, *Elytrigia repens* couch, common vetch and creeping thistle declined with increasing cutting; while, *Agrostis stolonifera* creeping bent, perennial rye-grass, *Poa* spp. meadow grasses, *Phleum pratense* timothy, cocksfoot, dandelion, *Trifolium repens* white clover and creeping buttercup increased with increased cutting from zero, two and five cuts per annum. Two or more cuts a year may be an effective management for the control of creeping thistle.

In this investigation the neutral grasslands responded to the most recently applied treatment, even after short rotations of other treatments. Most change occurred in the first year or first two years that followed the change in management treatment. Hay harvesting or flail cutting proved effective means for restoring the plant species richness of uncut grasslands. There is evidence however (e.g., Gibson 1986) that where rarer species are present and often sensitive to change, inappropriate management could lead to their elimination so that recovery would not readily occur.

In any study of vegetation dynamics there is a need to partition the variability into its components (Austin 1981). Variability may, in addition to management treatments, include successional trends, climatic fluctuations, cyclic changes and random effects. In particular, climatic fluctuations on the annual legumes and the grasses appeared to have some influence during the period of this investigation and have been discussed by Williams and Fowler (1997). For the grasses there was a reduction in the average species richness in all three treatments between 1989 and 1990. For forbs the effect was also most marked in 1989–90, but whereas grasses declined in that year, forbs increased, due largely to the annual legumes.

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References

AUSTIN, M.P. 1981. Permanent quadrats: an interface for theory and practice. *Vegetatio* **46**: 1–10.

BOLTON, D.K. 1971. Harrow, including Pinner. *In* Cockburn, J.S. and Baker, T.F.T. (eds) *The Victoria history of the counties of England. A history of Middlesex* **4**: 169–269. The University of London Institute of Historical Research. Oxford University Press.

BOLTON, D.K. 1976. Kingsbury. *In* Baker, T.F.T. (ed.) *The Victoria history of the counties of England. A history of Middlesex* **5**: 49–88. The University of London Institute of Historical Research. Oxford University Press.

CARSON, W.P. and PICKETT, S.T.A. 1990. Role of resources and disturbance in the organization of an old field plant community. *Ecology* **71**: 226–238.

CURTIS, J.T. and McINTOSH, R.P. 1950. The interrelations of certain analytic and synthetic phytosociological characters. *Ecology* **31**: 434–455.

FILLIBEN, J.J. 1975. The probability plot correlation coefficient test for normality. *Technometrics* **17**: 111–117.

FOWLER, J. and COHEN, L. 1990. *Practical statistics for field biology.* Open University Press, Milton Keynes.

GARRETT, A.J. 1935. *The historical geography of the Upper Brent.* Unpublished.

GIBSON, C.W.D. 1986. Management history in relation to changes in the flora of different habitats on an Oxfordshire estate, England. *Biol. Cons.* **38**: 217–232.

GREIG-SMITH, P. 1983. *Quantitative plant ecology.* Blackwell, Oxford.

GRIME, J.P. 1990. Mechanisms promoting floristic diversity in calcareous grasslands. *In* Hillier, S.H., Walton, D.W.H. and Wells, D.A. (eds) *Calcareous grassland — ecology and management*: 51–56. Bluntisham Books, Huntingdon.

HANSSON, L. 1977. Spatial dynamics of field voles *Microtus agrestis* in heterogeneous landscapes. *Oikos* **29**: 539–544.

KERSHAW, K.A. and LOONEY, J.H.H. 1985. *Quantitive and dynamic plant ecology.* Edward Arnold, London.
LANE, S. 1995. The current options for set-aside and the Countryside Stewardship Scheme. *In* Colston, A. and Perring, F. (eds) *Insects, plants and set-aside*: 1–10. Botanical Society of the British Isles, London.
LEUTERT, A. 1983. Einfluss der Feldmaus, *Microtus arvalis* (Pall.), auf die floristische Zusammensetzung von Wiesen-Oekosystemen. *Veröff. geobot. Inst. Zurich* **79**: 7–126.
OOMES, M.J.M. and MOOI, H. 1981. The effect of cutting and fertilizing on the floristic composition and production of an *Arrhenatherion elatioris* grassland. *Vegetatio* **47**: 233–239.
PARR, T.W. and WAY, J.M. 1988. Management of roadside vegetation: the long-term effects of cutting. *J. appl. Ecol.* **25**: 1073–1087.
STACE, C. 1991. *New flora of the British Isles.* Cambridge University Press.
USHER, M.B. 1991. Scientific requirements of a monitoring programme. *In* Goldsmith, F.B. (ed.) *Monitoring for conservation and ecology*: 15–32. Chapman and Hall, London.
WELLS, T.C.E. 1980. Management options for lowland grassland. *In* Rorison, I.H. and Hunt, R. (eds) *Amenity grassland — an ecological perspective*: 175–195. John Wiley and Sons.
WESSON, G. and WAREING, P.F. 1969. The role of light in the germination of naturally occurring populations of buried weed seeds. *J. exp. Bot.* **63**: 402–413.
WILLIAMS, L.R. and FOWLER, J.A. 1997. Towards a 'common plant census' to monitor environmental change. *Lond. Nat.* **76**: 67–78.
WILLIAMS, L.R. and NORTHCROFT, K. 1992. Heritage land: the case for Fryent Country Park. *Lond. Nat.* **71**: 33–42.

Book reviews

Who am I? — Furry and fluffy-tailed. Moira Butterfield. Belitha Press. 1998. 32 pp., fully illustrated, with descriptive text. £6.99 hardback. ISBN 1 85561 815 X.

I am an elephant. Moira Butterfield. Belitha Press. 1999 [1998]. Boardbook, 10 pp., each illustrated with one line of text. £2.99. ISBN 1 85561 818 4.

Looking at animals in trees. Moira Butterfield. Belitha Press. 1999. 23 pp., fully illustrated with descriptive text. £8.99 hardback. ISBN 1 84138 023 7.

The ***Who am I?*** series by Moira Butterfield is a delightful collection of twelve short books which gives the young learner-reader a great insight into the wildlife in the world around them. ***Furry and fluffy-tailed*** is one of the books which enables one to see into the life of the common rabbit. Each beautifully illustrated page shows part of the rabbit and invites the young reader to guess what the animal is. Another good feature of this book is that as each body part is shown, the author has explained how the part is beneficial to the chosen animal. This helps the reader gain knowledge as well as enjoy the story. Once the body parts are named there is a simple fun quiz for the reader along with details of young, habitat and a useful glossary.

This is a good book for parents to read to their children, as it makes an interesting story and is a fun way to learn about the wildlife around them. It would also be a good book for the slightly more confident reader as the simple language used is easily understood. The suggested age range is 4 to 7 years.

The ***I am a . . . .*** series is similar to the ***Who am I?*** series. Its simple language and good quality pictures are aimed at a young audience and it invites them to guess what the animal is. ***I am an elephant*** goes through the parts of the body and shows the young and habitat. It helps the reader to recognize the chosen animal, and is a fun and enjoyable approach to teaching your child about animals.

This series does not include any native British animals as yet (the three other titles are alligator, bear and tiger), so is not the best of books for showing a young child animals they are likely to encounter in the wild. It is, however, still a good quality book for showing elephants in their natural habitat and an excellent learning aid which everyone can enjoy. The suggested age range is 1 to 3 years.

Looking at animals in trees is perfect for the more-confident young reader, and less-confident children would enjoy having this book read to them. It covers a wide range of different animals that live in trees from around the world. It contains both familiar animals, such as the squirrel, and more unusual animals such as the ocelot.

Each animal is given a double spread with big colourful photographs of the animal in its natural environment. The writer has skilfully described each animal's appearance and a little about its lifestyle in simple sentences so the reader can understand. There is even a world map at the back to enable the reader to identify where each animal can be found, and a glossary to explain some of the words. The recommended age range is 4 to 7 years.

R. Plant

Leatherback turtle *Dermochelys coriacea* from the Thames Estuary, with notes on reporting and rehabilitation

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Summary

An adult leatherback turtle was observed alive in the tidal reaches of the River Thames in November 1998. The turtle appeared lethargic when first encountered, and a turtle — presumably the same one — was found dead about a month later, with a large wound that was believed to have been caused by a boat propeller. The carcase was eventually transported for post-mortem to the Institute of Zoology at Regent's Park. Leatherback turtles are considered to be native to UK waters in their north-east Atlantic range. Causes of mortality are a concern for this large and relatively rare marine reptile. Procedures for the reporting of finds, and for the examining of carcasses, of turtles need to be prepared and co-ordinated.

Background

Readers may be surprised at this rare natural event. I cannot remember any records of wild sea turtles in the London Natural History Society recording area and such an event is unlikely to escape reporting. The finding of introduced terrapin species is not now infrequent in the River Thames and its tributaries, but of the marine turtles, the large and heavy adult leatherback turtle is only likely to have been present by natural means.

The leatherback or leathery turtle is a marine reptile that is native to Britain's coastal waters, where it feeds on jellyfish on a seasonal basis in autumn prior to southerly movements to warmer waters during the winter (Anon. 1984).

The English counties that have an east-coast shoreline have had only one or two records each of leatherback turtle strandings in recorded history. Such dead turtle strandings have not been examined before in detail in the veterinary sense. The death either through natural causes or entanglement in fishing gear, or a combination of both, somewhere in the North Sea has not been clearly attributed, although entanglement is suspected as a prime cause in many cases where turtles have had cut marks and rope burns on their bodies. Government advice to the UK fishing fleet and coastguards covering sightings, strandings and net and live entanglement has been developed in recent years (NCC 1989), but has only been revised and issued for Scotland.

Report of the incident

The occurrence of the turtle was first reported to me by Clive Herbert of the London Amphibian and Reptile Trust (formerly Group). A press cutting from *The Kent Messenger* (1998) was also drawn to my attention. After a day or two of checking I was able to reconstruct the likely order of events from the fragmented evidence and to determine the likely movements of the turtle from when it was first seen alive on 26 October to its transportation for post-mortem on 3 December.

The turtle was first reported by David Cole, a leading hand for the Port of London Authority. At 13.40 hrs on 26 November 'we approached, thinking it looked like an upturned boat or an old tyre floating in the water. We went up alongside it and the turtle lifted its head but appeared dopey and on its way out. We followed it for five to ten minutes, after which we left to get a camera but on our return we did not see it again. Its head had a pink or red nine-inch patch on it that did not look right'. The location of this first sighting was a quarter of a mile below the lighthouse at Broadness, some two miles below the Queen Elizabeth Bridge, 200–300 yards out from the south shore at Ordnance Grid reference TQ613765.

A leatherback turtle, almost certainly the same animal, was found dead twenty-seven days later on 22 November at 10.00 hrs at Tilbury Dock, floating on the east side of the main dock entrance of the north shore (TQ625754) by Mick Kirby, a waterman for Palmer Marine Services. He telephoned the Reptile Section of The Natural History Museum, the Environment Agency and the Institute of Zoology for advice. He reported that 'the turtle had a large gash in its side almost certainly caused by a propeller and had some of its guts hanging out. It did smell a bit but it was quite fresh and still bleeding. We towed it to Denton where it was tied up and photographed but no one wanted it so we towed it out and let it go'. From the look of the turtle, that was well illustrated in photographs sent to me by Mick Kirby, the turtle had been dead for at least a week and possibly two to three weeks. This suggests to me that the turtle died or was killed in a lethargic state within a week or so of it being first sighted, which is not surprising in one of the world's busiest shipping lanes. The photographs show that the rear third of the turtle was all but chopped off with a single massive oblique slicing blow.

The turtle was next seen on the north shore of the Erith Rands next to Aveley Marshes at TQ543788 where it was washed up by the neap tide, probably on 27 November, and left on the mud bank about twenty-five metres out. Clive Herbert reported it to me on Sunday 29 November when he photographed it (Figure 1). 'It had a large gash on one side of its body with guts hanging out and one of the eyes looked damaged, probably by a scavenger'.

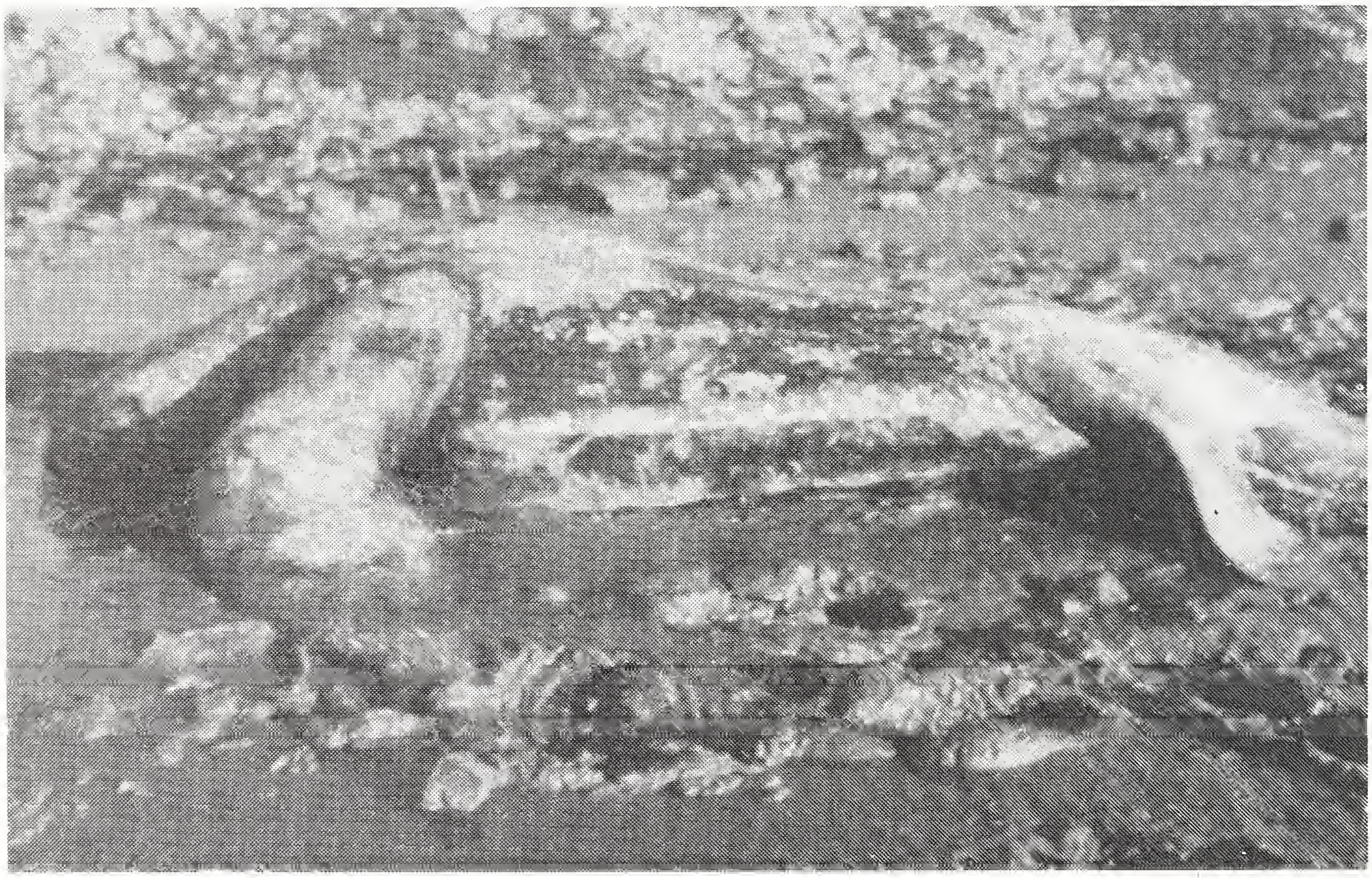

FIGURE 1. Leatherback turtle *Dermochelys coriacea* in the Thames Estuary at Erith Rands, 29 November 1998. *Photo: Clive Herbert*

The turtle was recovered with the help of Daniel Bennett and Rachael Hill from the Environment Agency NE Area (Thames Region) who provided transportation for the turtle on 3 December 1998 when it was taken to the Institute of Zoology where Tony Sainsbury and Javier Lopez took charge of the fairly decomposed remains.

Andrew Cunningham at the Institute of Zoology is organizing a number of tests on body tissues of the 'Tilbury' turtle and in addition to the visual inspection will be reporting on two other English east coast leatherback turtle mortalities in due course.

In addition to its huge cut, the Tilbury turtle had a flat, sharp-edged, irregular fragment of brown 2 mm thick plastic approximately 11 mm × 75 mm at the entrance to its stomach. This could not be identified precisely by the British Plastics Federation but was considered likely to be a broken piece of a storage or handling crate or bucket. The turtle's total length (nose to tail tip) was in the region of 2.2 metres with a straight carapace length of about 1.5 metres. The total weight of the turtle was about 250 kg.

Discussion

The leatherback turtle that was recovered from the River Thames in December 1998 was one of four turtles that were found on the east coast of England over a fifteen-month period between October 1997 and December 1998. One of the other turtles was also found entering brackish water near Spalding, Lincolnshire, while the other two were dead, stranded on beaches in Suffolk (Langton et al., in press) and Northumbria. Post-mortems are being conducted to try to determine the cause(s) of death in each case. The chance of death of old and weak, diseased or injured turtles may be enhanced in British coastal waters in winter months as the sea surface temperatures drop to close to freezing. For the two turtles that were alive and moving inland in estuarine conditions, the cold temperatures will not have helped them to survive. In one of the cases of stranded turtles, net entanglement appears to have contributed to the mortality and with two of the other cases the full results of the post-mortems are yet to be determined.

Conclusions and recommendations

The turtle would not have been examined unless the action taken by the London Amphibian and Reptile Trust and my own LNHS/Froglife 'hats' had got the transport and post-mortem organized. Bringing together of the relevant organizations in cases of marine (and coastal) strandings/sick turtle sightings is a relatively simple job that just needs co-ordinating by the responsible body. Both English Nature and the Environment Agency should help in the process, and action in my view has been well overdue (Langton 1999) for some time.

With the Tilbury turtle, only by the interest 'beyond the call of duty' did the Environment Agency and the Institute of Zoology give their expert advice and help.

Recommendation 1. The Environment Agency and English Nature should co-ordinate a set of instructions, to be widely distributed, concerning the immediate reporting of sick or dead turtles to a twenty-four-hour emergency hotline that would put a capture/recovery procedure into action.

Recommendation 2. A turtle recovery procedure should be designed by the Department of the Environment, Transport and the Regions with the assistance of The Environment Agency and English Nature and put in place throughout England so that the responsibilities and costs of recovery, examining and testing or treating sick or dead turtles can be streamlined according to a well thought out recovery, examination and post-mortem or wild release/captive care procedure. The process should interlink with equivalent effort across Britain and Ireland with the assistance of the Joint Nature Conservation Committee.

Recommendation 3. The centre of expertise in turtle examination at the Institute of Zoology, London should be fully supported to continue their excellent work.

Recommendation 4. Nature conservation, marine vertebrate handling, veterinary and welfare experts and organizations should establish a procedure for the attempted care, treatment and release of leatherback turtles, in consultation with researchers who would be involved in monitoring the turtle movements after their release.

Apparently some twenty to thirty years ago a live leatherback turtle was moved from the east coast of Scotland to the west coast in an attempt to release it closer to its natural point of southerly migration, but the turtle died in transit (Gabriel King, pers. comm.).

Once in captivity, consideration of methods for the detection and removal of gut obstructions represent new challenges, and post-operative recovery and feeding also are new areas. Once recovered, a healthy adult leatherback turtle could prove a very useful conservation asset and not just because of its breeding capacity. Given the very careful attachment of a suitably designed radio transmitter, movements of the turtle could be monitored.

It is rare for leatherback turtles to be found alive, and the Spalding and Tilbury turtles appear to be rare examples. The concept of rescue, caring for, treating for illness and even rehabilitation of river-trapped or live stranded/injured leatherbacks have never to my recollection been considered in any depth.

Leatherbacks are difficult to handle due to their weight and the risk of damage should they be lifted in the air. They find it difficult to breathe when on land and risk of suffocation in transport is a considerable factor. However, the mechanical methods should not be that much more difficult than those used for small cetaceans. Should a turtle be caught in a net, getting a purpose-made harness under it and lifting it into a transport container, possibly floating in water, does not seem out of the question, given the use of a purpose-built lorry. Risks associated with injuring or killing leatherbacks have put off those considering taking them at sea with nets for tagging purposes off the coasts of Britain and Ireland.

Readers seeing or hearing of large turtles in the Thames should report them immediately to both The Natural History Museum and the Institute of Zoology in London and to myself. Prompt reporting is very important.

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References

ANON. 1984. The turtle that needs protection in Britain. *Oryx* **18**: 195–196.

KENT MESSENGER. 1998. *Sad end for huge Thames turtle* and *Giant turtle dies in Thames.* 27 November.

LANGTON, T. 1999. Hell for leatheries. *BBC Wildlife.* March: 15–17.

LANGTON, T.E.S., BECKETT, C.L. and FOSTER, J.P. In press. First leatherback turtle stranding for Suffolk. *Trans. Suffolk Nat. Soc.*

NATURE CONSERVANCY COUNCIL. 1989. *The Turtle Code.* Waterproof laminate produced by NCC and Herpetofauna Consultants International.

Monitoring butterflies in north-west London in 1998

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Abstract

Collated indices of butterfly species for the year 1998 were estimated, based on the monitoring at four transects in north-west London. The transects were at Hampstead Heath, Fryent Country Park, Beane Hill and Gutteridge Wood. Comparison was made with the collated indices for each species during recent years. In 1998 the collated indices for the green-veined white *Pieris napi* and the peacock *Inachis io* were higher than in any year since the start of the series in 1986.

Introduction

Collated indices of butterflies in 1998, based upon monitoring at four transects in north-west London, are presented in this paper. The transects are the same as those covered in the earlier paper by Williams, Rix and Greenwood (1998). A transect at Hampstead Heath was established by Ray Softly in 1978, and from 1986 when a transect at Fryent Country Park was established, it is possible to estimate collated indices. Further transects were commenced at Beane Hill in 1988 and at Gutteridge Wood in 1990. Transect counts from an individual site provide considerable information about changes in the abundance of butterfly species, while collated indices from several sites provide a wider view of changes in the abundance of species and are less affected by habitat management effects at an individual site. Though this index covers four transects in north-west London, it could potentially accept data from further transects in London.

Collated indices provide an overview of the changing abundance of each species from year to year. Whether the changes in abundance are due to regional trends or to habitat management at individual sites, or to a combination of both, has to be interpreted from the data and from a knowledge of the individual species. Changes in abundance that are not specific to an individual site, are more likely to reflect London-wide fluctuations.

Methods

Butterflies were surveyed at four sites using the transect walk method. This is a standard method and is not detailed here as it is well documented elsewhere, as are its limitations (Hall 1981, Pollard, Hall and Bibby 1986, Pollard 1991, Pollard and Yates 1993, Williams, Rix and Greenwood 1998). Basically, at each site, a walk is undertaken along the same route, each week, between April and September inclusive, within a standard range of weather conditions conducive to butterfly flight. Adult butterflies seen along the transect were counted to provide a total for each species for the year at each site. Totals used in this paper include estimates for weeks missed due to poor weather or the unavailability of the recorder(s), using averages of the two weeks on either side.

To calculate the collated indices a technique is required that ensures compatibility of the data from individual transects, which may vary from each other, for example in length, and the years in which they commenced. Provision had also to be made for the possibility that recording may cease at a transect in the future. Details of how to calculate the collated indices are explained by Pollard, Hall and Bibby (1986), and by Crawford (1991). It should be emphasized that the original site counts and the collated indices are not absolute counts of the populations, but indices of abundance. The indices are relative from year to year, not from species to species.

Sites

All four transects are on sites with an underlying London Clay and/or gravel surface geology, with neutral to acid soils (Plant 1994), and this has affected both the composition of the flora (Burton 1983) and indirectly the butterfly fauna. The four sites have varying quantities of woodland and are all within public open space.

Hampstead Heath

Transect established in 1978. Grid reference near to centre: TQ264870. The site is in the London Borough of Camden and managed by the Corporation of London. For a map of the transect route and for species data for the years 1978–1985 see Pollard, Hall and Bibby (1986). The transect is largely through scrub with rough grassland. In 1998 the Hampstead Heath transect was walked by Ian Greenwood with assistance from Aaron Beat and Bob Gillam of the Corporation of London. The data for 1978–1985 extend the Hampstead Heath series to twenty-one years, though it would be inappropriate to estimate the collated indices from one transect alone.

Fryent Country Park

Transect established in 1986. Grid reference near to centre: TQ195876. The site is in the London Borough of Brent, and managed by Brent Council with assistance from the volunteer Barn Hill Conservation Group. For a map of the transect route see Williams, Kwissa, Brown and Brown (1991). The transect includes hay meadows, hedgerows, woodland and scrub habitats. In 1998 the transect was walked by Leslie Williams with assistance from Paul Hutchinson.

Beane Hill

Transect established in 1988. Grid reference near to centre: TQ199873. The transect is in the south-east of Fryent Country Park in the London Borough of Brent, and managed by Brent Council with assistance from the volunteer Barn Hill Conservation Group. For a map of the transect route see Williams (1994). The transect is largely through young woodland which was planted in the mid to late 1980s. In 1998 the transect was walked by Leslie Williams with assistance from Paul Hutchinson.

Gutteridge Wood

Transect established in 1990. Grid reference near to centre: TQ091843. The site is in the London Borough of Hillingdon and managed by the London Wildlife Trust in association with the Borough Council. The transect includes a high proportion of mature oak woodland with a hazel understorey, grassland with scrub, boundary ditches and flowing water in the Yeading Brook. The transect is walked by Ann Rix.

Results

Collated indices for each species for the year 1998 were estimated. The indices and those for 1986 onwards are presented in Table 1. The relative changes in abundance for each species from year to year are given by the numerical figures. For example, a butterfly with an index of 50 in one year and 25 in the following year would have been approximately half as abundant on the four transects in the second year, as compared with the first year. Indices have been set at 100 in 1990 or the first year of record: for a technical discussion see Crawford (1991). Indices in the table have been rounded to the nearest whole number. Note that the initial two transects were joined by Beane Hill in 1988 and by Gutteridge Wood in 1990.

The order of species and their nomenclature is taken from Thomas (1986).

SMALL SKIPPER *Thymelicus sylvestris* and ESSEX SKIPPER *Thymelicus lineola*

The small and the Essex skippers are generally counted together by the transect walkers, due to the difficulty of separating these species in flight. Both species have however, been identified at four transects. There is considerable variation in numbers from year to year, and from site to site, so caution is necessary in drawing conclusions. However, the 1998 collated index was the lowest since the start of the index in 1986 (Figure 1). Numbers were down on all four transects as compared with 1997, and in particular at Fryent Country Park and Beane Hill. A similar effect was noted throughout Hertfordshire and Middlesex (Murray and Souter 1999). Aside from annual fluctuations, there is evidence that the area of rough grasslands at the Fryent Country Park/Beane Hill site has declined, with losses to scrub and woodland, which may account for some of the reduction. At Hampstead Heath, the numbers recorded in 1997 and 1998 were the highest since the transect commenced in 1978. This would suggest an improvement in the grassland habitat of these species at Hampstead Heath; and it has been noted that during the past five to six years, some areas of previously mown grasslands have been allowed to grow longer, though these are not on the transect itself.

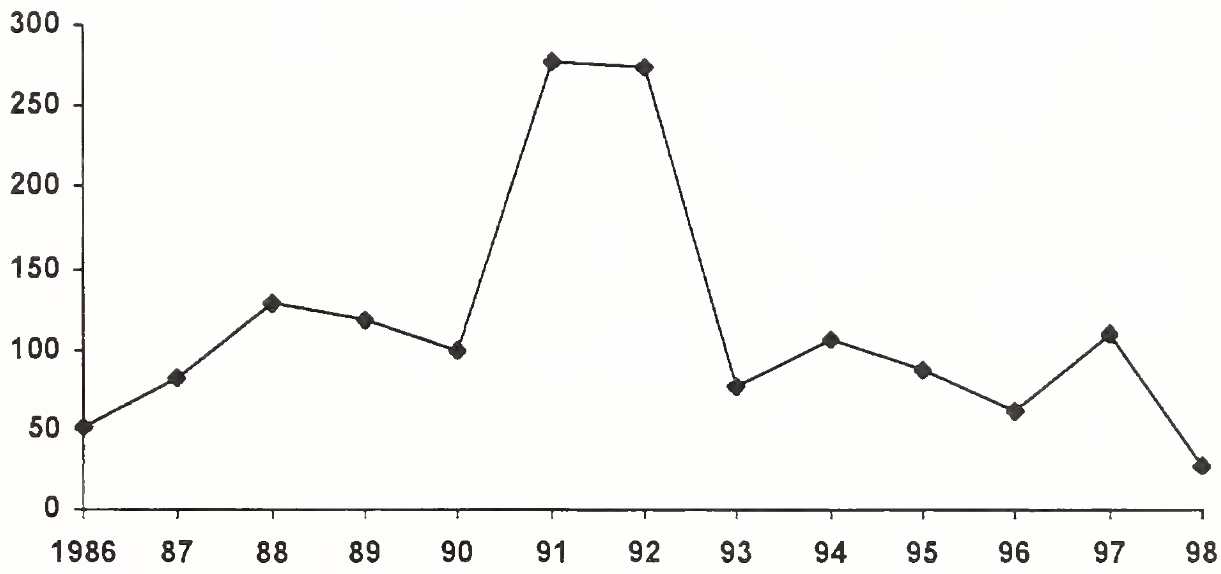

FIGURE 1. **Small** and **Essex skippers**: collated indices at four transect sites in north-west London for the years 1986–1998.

LARGE SKIPPER *Ochlodes venata*

The collated index was the lowest since the series commenced in 1986 (Figure 2). Compared with 1997, numbers were lower on three of the transects, but higher at Beane Hill. Part of the decline may be due to a reduction in rough

Table 1. Collated indices for butterfly transects in north-west London: Hampstead Heath (from 1986), Fryent Country Park (from 1986), Beane Hill (from 1988), and Gutteridge Wood (from 1990). Note therefore the smaller sample sizes prior to 1990. Indices set at 100 in 1990, or first year of record.

	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Small and Essex skippers	52	82	128	118	100	277	274	78	107	88	61	110	27
Large skipper	53	123	63	204	100	56	204	179	200	120	72	66	45
Clouded yellow											100	0	0
Brimstone					100	133	217	150	82	280	115	328	328
Large white	142	39	142	321	100	128	1331	172	183	279	100	321	521
Small white	568	122	171	248	100	155	264	71	118	289	84	240	113
Green-veined white	65	34	140	162	100	51	238	71	78	115	75	173	275
Orange-tip	2	18	10	35	100	63	90	68	27	69	27	60	65
Purple hairstreak							100	200	200	100	0	500	300
White-letter hairstreak							100	50	0	0	150	50	0
Small copper	3	19	10	55	100	48	17	4	38	15	50	27	23
Common blue	8	8	0	54	100	7	70	15	155	144	48	200	74
Chalkhill blue												100	0
Holly blue				105	100	15	6	0	2	23	67	2	30
White admiral													100
Red admiral			100	25	100	40	400	140	120	613	416	138	217
Painted lady			100	0	100	10	20	0	0	10	1040	0	0
Small tortoiseshell	239	342	461	257	100	120	1055	412	151	276	174	210	176
Peacock	131	192	161	121	100	173	334	346	259	311	458	380	675
Comma	79	135	140	185	100	73	473	170	145	194	176	197	215
Speckled wood		18	59	139	100	75	172	213	321	174	96	168	212
Wall brown	27	21	0	89	100	13	3	3	3	0	0	0	0
Marbled white											100	0	0
Gatekeeper					100	86	108	57	57	73	98	102	87
Meadow brown	33	110	155	162	100	209	100	25	51	79	140	116	148
Small heath	42	57	11	37	100	40	32	2	1	1	0	0	5

grassland habitat at some sites. An overall reduction in the index for this species, as for the small and Essex skippers, was also noted throughout Hertfordshire and Middlesex (Murray and Souter 1999).

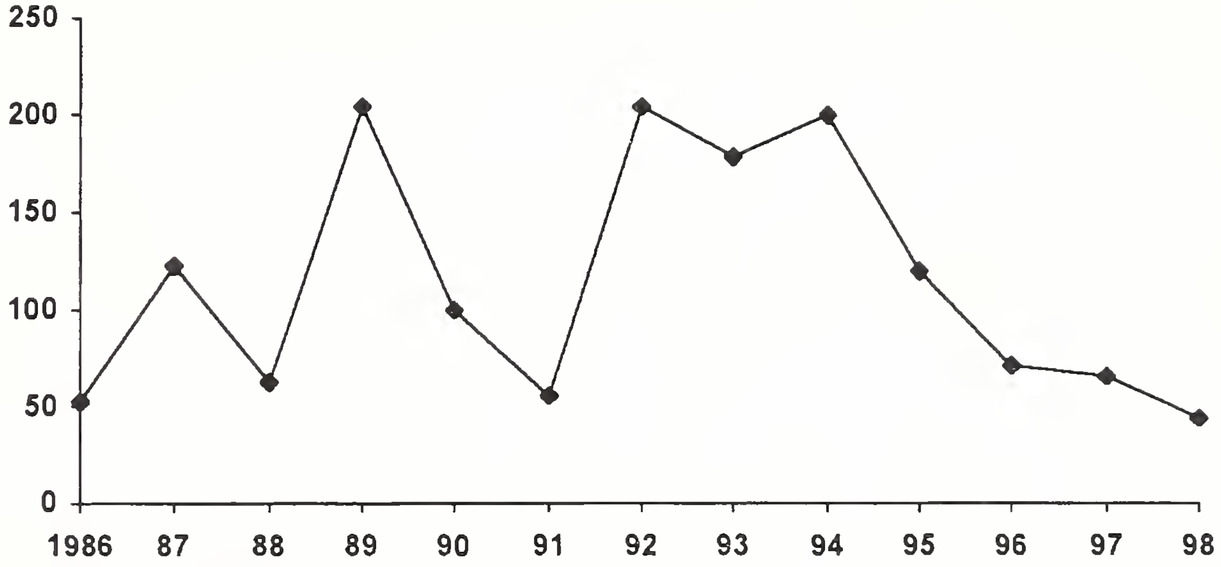

FIGURE 2. **Large skipper**: collated indices at four transect sites in north-west London for the years 1986–1998.

BRIMSTONE *Gonepteryx rhamni*

The collated index was the same as in 1997, hence the joint highest since comparable records for this species commenced in 1990. The numbers on each transect were also similar to the 1997 totals. There is evidence that the brimstone has become established at Hampstead Heath where it was first recorded in 1993, and at Beane Hill where the first record was in 1995. Overall the brimstone appears to be increasing at the transect sites in north-west London (Figure 3).

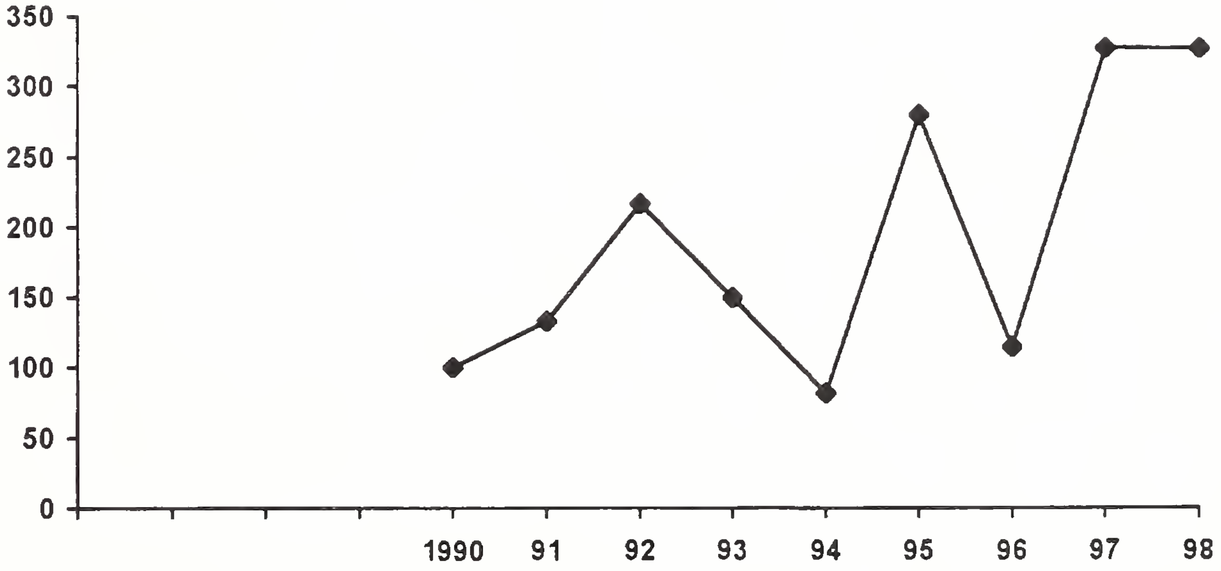

FIGURE 3. **Brimstone**: collated indices at four transect sites in north-west London for the years 1986–1998.

LARGE WHITE *Pieris brassicae*

A relatively high collated index for this species and the highest since 1992. A similar increase as compared with 1997 was noted throughout Hertfordshire and Middlesex (Murray and Souter 1999). The annual changes in abundance appear to be due largely to regional environmental factors; and in particular, the effects of the weather at each stage of the life cycle.

SMALL WHITE *Pieris rapae*

The collated index was lower than in 1997. A decrease as compared with 1997 was noted throughout Hertfordshire and Middlesex (Murray and Souter 1999).

As for the large white and green-veined white, much of the annual changes in abundance of the small white could be attributed to the complex effects of the weather at various stages of the life cycle.

GREEN-VEINED WHITE *Pieris napi*

In 1998 the green-veined white had its best year since the index commenced in 1986 (Figure 4). Compared with 1997, the numbers recorded increased at all four transects. An increase as compared with 1997 was also noted throughout Hertfordshire and Middlesex (Murray and Souter 1999).

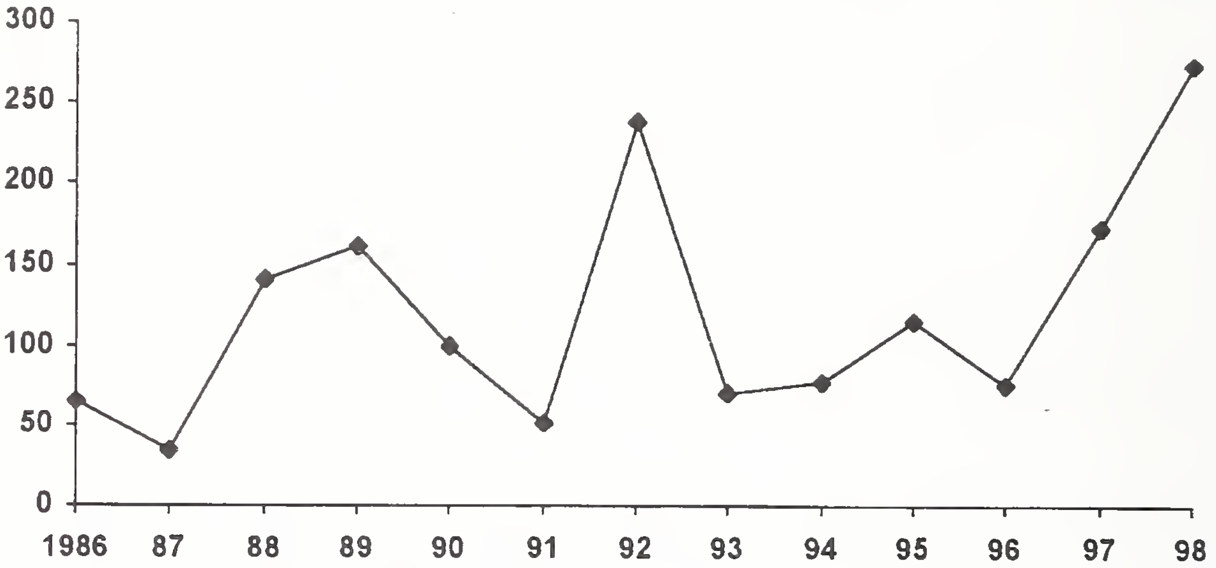

FIGURE 4. **Green-veined white**: collated indices at four transect sites in north-west London for the years 1986–1998.

ORANGE-TIP *Anthocharis cardamines*

The collated index was similar to that for 1997, though there was no consistent pattern between the transects, due possibly to the small numbers recorded.

PURPLE HAIRSTREAK *Quercusia quercus*

The purple hairstreak is generally on the wing in the evening only and therefore it is one of the few butterfly species for which transect recording is inappropriate. The small numbers recorded on the transects, between 10.45 and 15.45 hours, make it difficult to comment upon possible trends. The purple hairstreak has however, been recorded on all four transects, rather than only three, as stated in error in Williams et al. (1998). In 1998 two individuals were recorded on the Gutteridge Wood transect and one on the Hampstead Heath transect.

SMALL COPPER *Lycaena phlaeas*

A slightly lower collated index than in 1997, though the total number of individuals recorded was only eleven.

COMMON BLUE *Polyommatus icarus*

The collated index was lower than in 1997. A reduction as compared with 1997 was also noted throughout Hertfordshire and Middlesex (Murray and Souter 1999).

HOLLY BLUE *Celastrina argiolus*

The holly blue was recorded on all four transects with fifteen individuals seen as compared with two in 1997.

WHITE ADMIRAL *Ladoga camilla*

A single individual was recorded on the Gutteridge Wood transect, the first record at that site and for the collated index. The white admiral is a species of large woodlands and there have been only occasional records of the species in London (Plant 1987), though it is established in some woodlands in the more rural areas beyond London.

RED ADMIRAL *Vanessa atalanta*

Eleven individuals were recorded with the collated index considerably higher as compared with that of 1997.

SMALL TORTOISESHELL *Aglais urticae*

The index was lower than in 1997. However the number of butterflies recorded increased at Beane Hill, but declined at the other transects, with none on the Gutteridge Wood transect. Numbers of the small tortoiseshell are subject to large changes each year (Table 1) and reflected the changes noted in Hertfordshire and Middlesex (Murray and Souter 1999).

PEACOCK *Inachis io*

The highest collated index since the series commenced in 1986 (Figure 5). The general trend of the index since 1986 also appears to be increasing, perhaps in response to an increase in woodland edge habitat. Record counts were made on the Hampstead Heath, Fryent Country Park and Beane Hill transects.

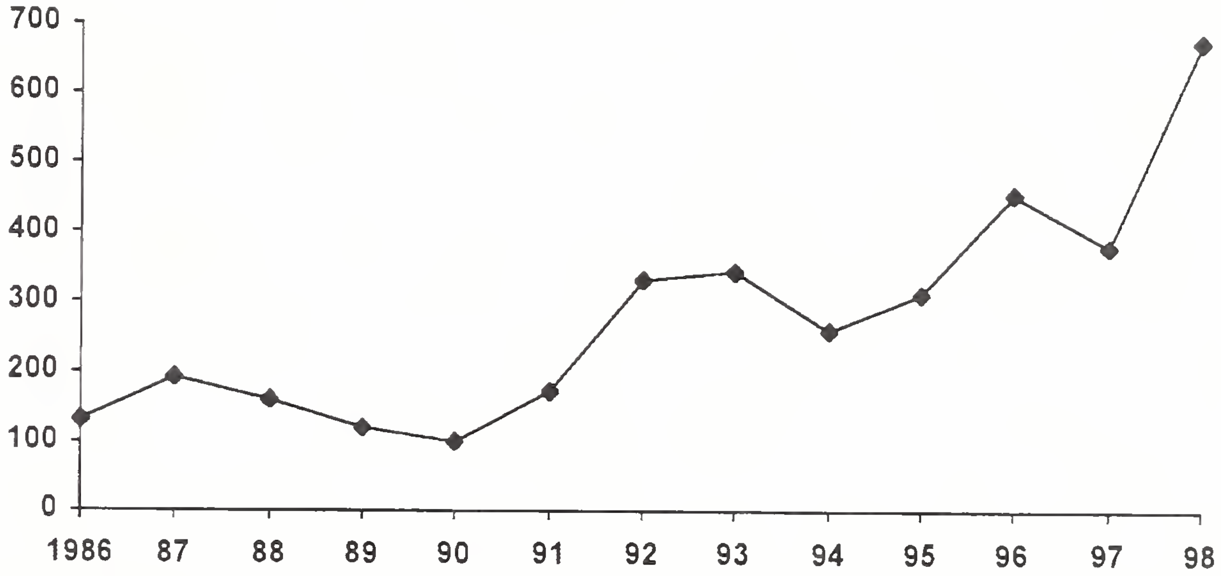

FIGURE 5. **Peacock**: collated indices at four transect sites in north-west London for the years 1986–1998.

COMMA *Polygonia c-album*

The collated index was slightly higher than in 1997 and the highest since 1992. The species appears to be increasing at the Fryent Country Park/Beane Hill site.

SPECKLED WOOD *Pararge aegeria*

With the exception of the Hampstead Heath transect, numbers were up at all sites as compared with 1997 and giving a higher collated index overall (Figure 6). The species responds to annual fluctuations, but has increased since 1986 as a result of the establishment of new colonies. The speckled wood prefers woodland and woodland edge habitats.

GATEKEEPER/HEDGE BROWN *Pyronia tithonus*

Whilst the index was lower than in 1997 (Table 1), there were differences between the transects. As compared with 1997, the numbers of gatekeepers recorded were lower at Gutteridge Woods and Beane Hill, but there was a slight increase at Fryent Country Park. At Gutteridge Wood (Figure 7), where the gatekeeper was already established when the transect joined the index in 1990, there appears to be a downward trend. At the other three transect sites; Fryent Country Park, Beane Hill and Hampstead Heath (Figure 8), the gatekeeper has become established, followed by a rapid increase in numbers since 1993. For example, at Hampstead Heath prior to the establishment of the collated index, a single gatekeeper was observed on the transect in 1985, with another in 1990, and from 1993 it has been recorded annually as the population has increased.

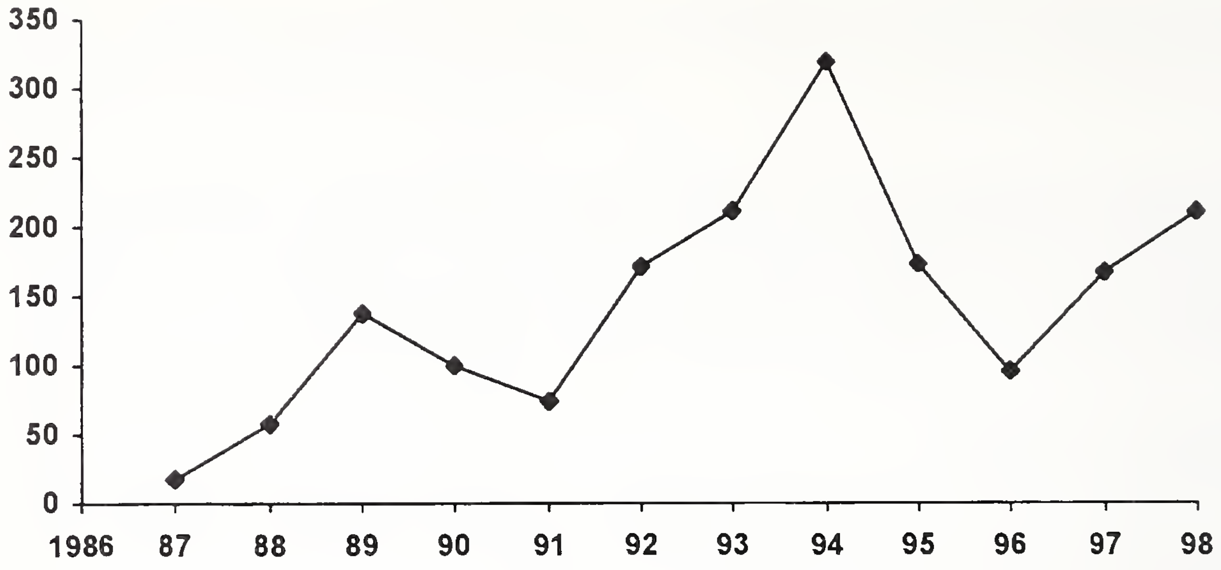

FIGURE 6. **Speckled wood**: collated indices at four transect sites in north-west London for the years 1986–1998.

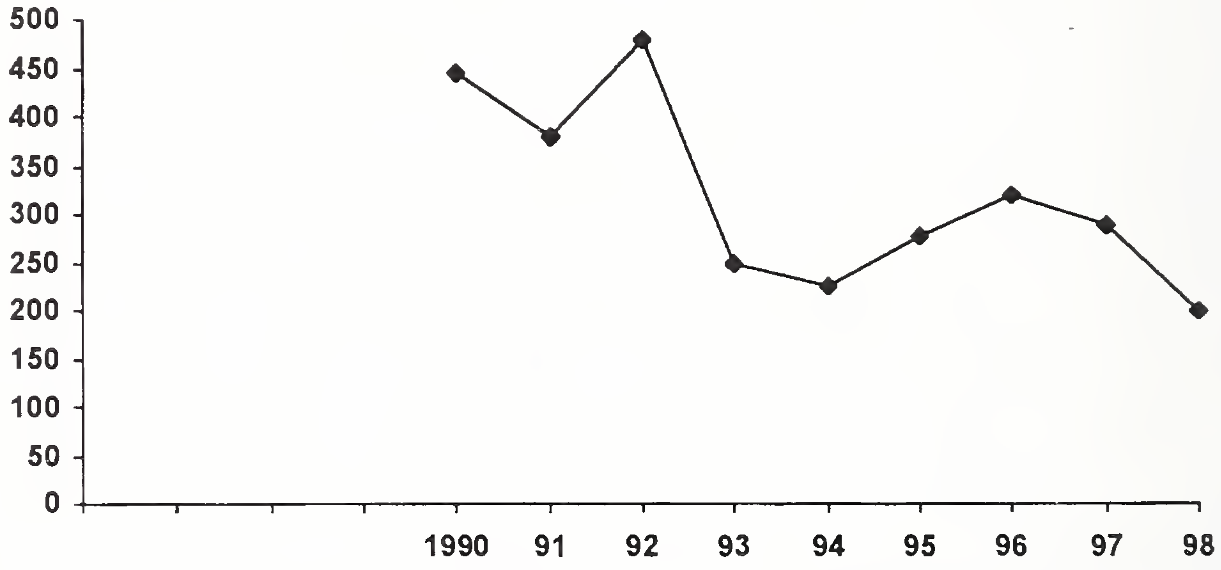

FIGURE 7. **Gatekeeper**: at Gutteridge Wood. The numbers of gatekeeper butterflies recorded on the transect at Gutteridge Wood for the years 1990–1998. The numbers include estimated counts for weeks with missing data.

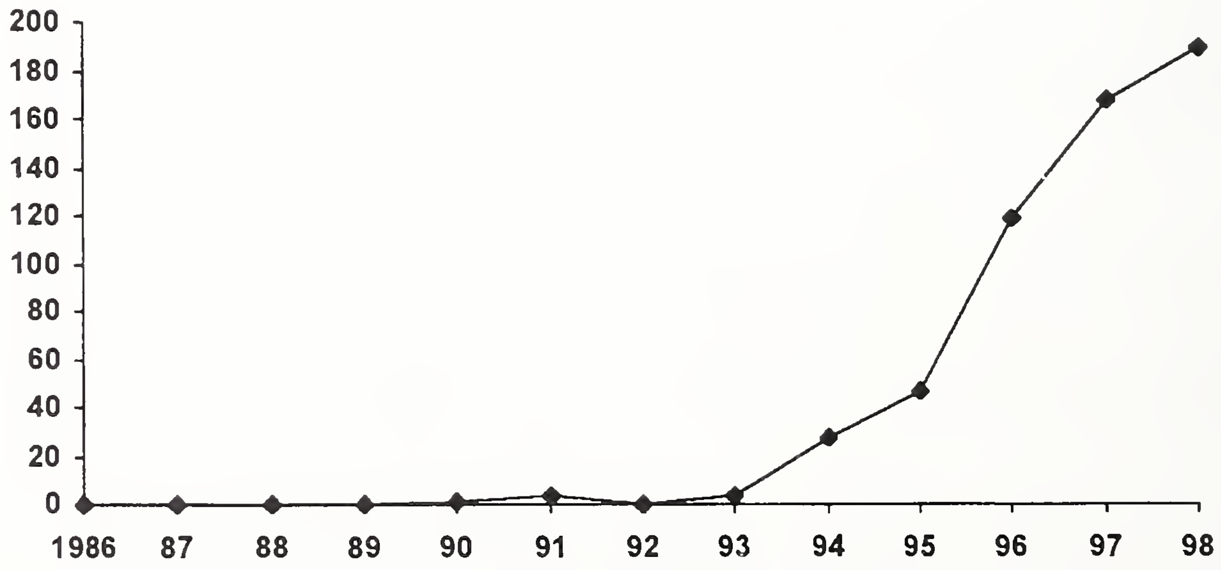

FIGURE 8. **Gatekeeper**: new colonies. The numbers of gatekeeper butterflies recorded on transects on which the gatekeeper has become established since 1986. These transects are Hampstead Heath, Fryent Country Park and Beane Hill. The numbers include estimated counts for weeks with missing data.

MEADOW BROWN *Maniola jurtina*

The index was the highest since 1991 (Figure 9). Numbers recorded were higher at all four transects as compared with 1997. At Fryent Country Park the total transect count was 3,159.

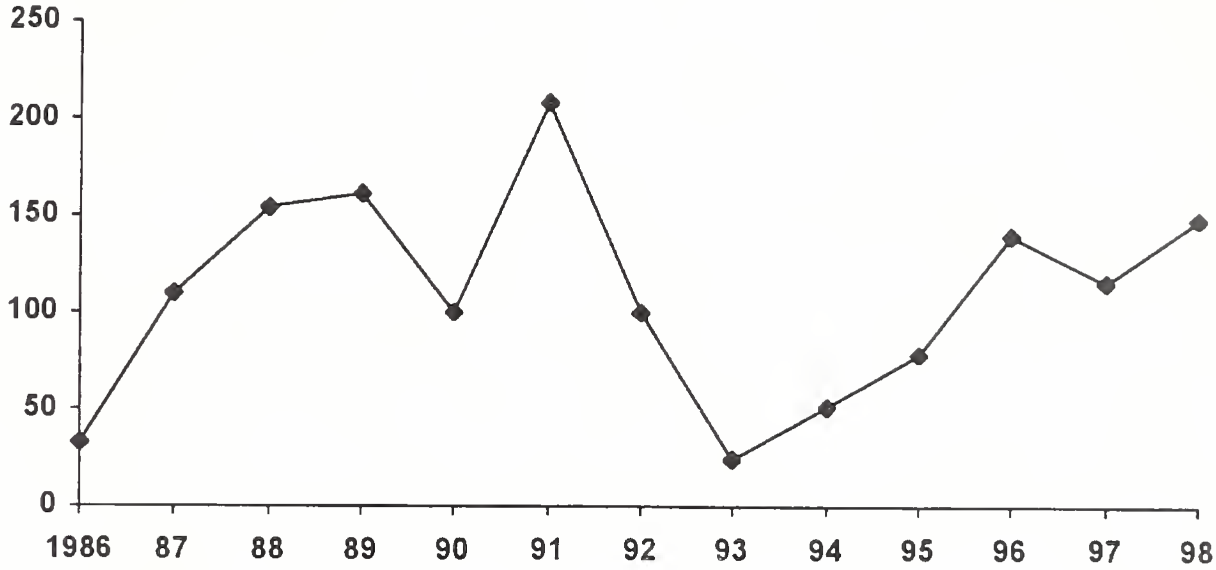

FIGURE 9. **Meadow brown**: collated indices at four transect sites in north-west London for the years 1986–1998.

SMALL HEATH *Coenonympha pamphilus*

The first record since 1994, with five individuals recorded on the Gutteridge Wood transect. A colony had persisted at that site, but away from the transect and these records probably refer to movements from that colony. Nevertheless the species has suffered a considerable decline since the peak collated index in 1990 (Figure 10) and when it was also present on the Fryent Country Park and Beane Hill transects.

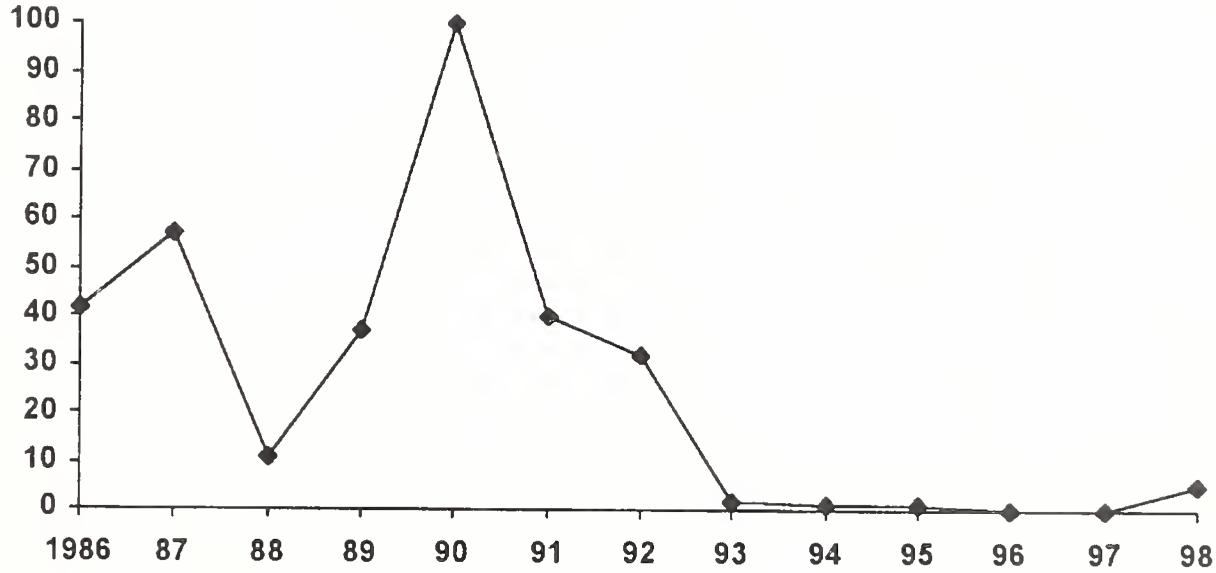

FIGURE 10. **Small heath**: collated indices at four transect sites in north-west London for the years 1986–1998.

The following species have previously been recorded on at least one of the four transects but were not recorded in 1998: clouded yellow *Colias croceus*, white-letter hairstreak *Strymonidia w-album*, chalkhill blue *Lysandra coridon*, painted lady *Cynthia cardui* (none recorded for the second successive year, as compared with the 104 individuals during the record year of 1996), wall brown *Lasiommata megera* (this was the fourth year without a record from any of the four transects and followed a decline from a peak in 1990) and marbled white *Melanargia galathea*.

Discussion

The collated indices provide information on changes in the abundance of butterflies on four transects in north-west London. Changes in abundance may reflect the fluctuations in north-west London and in London as a whole. This is probably the case for species that displayed similar fluctuations in abundance from site to site. For example, in 1998 the green-veined white and the peacock were recorded in high numbers at all four transects. The skippers appeared to have had a poor year at most sites, though changes in grassland management appear to be encouraging some of the skippers at Hampstead Heath. There appeared to be agreement with the general trends for the Hertfordshire and Middlesex area (Murray and Souter 1999), though where differences are apparent it may be useful to examine these over a period of several years, rather than year upon year differences.

Some species are largely dependent upon the semi-natural habitats at individual sites. Changes in abundance of these species will both reflect habitat management at the individual sites and the factors affecting the regional abundance of those species. Most transect sites consist of a complex set of habitats and of variations in habitat management. Since the transect walkers tend to divide their transect into identifiable sections, an investigation of the effects of habitat management on each butterfly species could be attempted by an analysis of the sectional data from each transect. This could include comparison between sections and years.

A limitation of these results is the relatively small number of transects in the index. The national scheme uses data from over eighty transects (Pollard, Hall and Bibby 1986). There is however no standard number; indeed data from just one transect can provide considerable information, while other indices are based on regional areas or particular habitats (e.g., chalk grassland). Collated indices allow for some loss and recruitment of sites, but it is continuity at the longer-running sites that is more valuable. While the transects in this index are all from north-west London at present, data could be accepted from other transects in London. Thus monitoring could provide data on both the changes in butterfly abundance at the individual sites and provide a more reliable index for the London area.

Acknowledgements

We acknowledge the earlier and other members of the recording teams at each site, in particular, Ray Softly at Hampstead Heath; and Anthony Kwissa, Julianne and David Brown at Fryent Country Park. We thank the landowners and local authorities: the Corporation of London, and the London Borough Councils of Brent, Camden and Hillingdon; and where these share site management, the Barn Hill Conservation Group and the London Wildlife Trust. We would also like to thank Catherine Warren and Shaun Faulkner of Brent Council Parks Service, and Caroline Williams for their help during the preparation of this paper. We acknowledge the British Trust for Conservation Volunteers, The Millennium Commission for encouragement to develop further some aspects of this project, and the comments of a referee.

References

BURTON, R. M. 1983. *Flora of the London Area.* London Natural History Society.

CRAWFORD, T. J. 1991. The calculation of index numbers from wildlife monitoring data. *In* Goldsmith, B. (ed.) *Monitoring for conservation and ecology*: 225–248. Chapman and Hall, London.

HALL, M. L. 1981. *Butterfly Monitoring Scheme. Instructions for independent recorders.* Institute of Terrestrial Ecology.

MURRAY, J. B. and SOUTER, R. 1999. *Hertfordshire and Middlesex butterfly and moth report for 1998.* Hertfordshire and Middlesex Branch, Butterfly Conservation.

PLANT, C. W. 1987. *The butterflies of the London Area.* London Natural History Society.

PLANT, C. W. 1994. A map of the surface geology of the London Area. *Lond. Nat.* **73**: 215–220 and supplement.

POLLARD, E. 1991. Monitoring butterfly numbers. *In* Goldsmith, B. (ed.), *Monitoring for conservation and ecology*: 87–111. Chapman and Hall, London.

POLLARD, E., HALL, M. L. and BIBBY, T. J. 1986. *Monitoring the abundance of butterflies 1976–1985*. Nature Conservancy Council.

POLLARD, E. and YATES, T. J. 1993. *Monitoring butterflies for ecology and conservation*. Chapman and Hall, London.

THOMAS, J. A. 1986. *Butterflies of the British Isles*. Country Life Books, Twickenham.

WILLIAMS, L. R. 1994. An adaptation of butterfly transect monitoring to survey human park visitors. *Lond. Nat.* **73**: 143–148.

WILLIAMS, L. R., KWISSA, A., BROWN, D. and BROWN, J. 1991. Butterfly monitoring at Fryent Country Park, Middlesex, 1986–90. *Lond. Nat.* **70**: 73–80.

WILLIAMS, L. R., RIX, A. and GREENWOOD, I. 1998. Monitoring butterflies at four open spaces in north-west London. *Lond. Nat.* 77: 91–106.

Fold-out charts review

Field Studies Council 'Occasional Publication' fold-out charts, available from Field Studies Council Publications, Preston Montford, Shrewsbury SY4 1HW, at £2.25 plus 75p p. & p. per chart, payable to FSC.

OP32 ***The woodland name trail. A key to invertebrates of soil and litter.*** Anne and John Bebbington and Steve Tilling. 1994. No ISBN.

OP33 ***[Grasses identification chart].*** Adapted from ***A lateral key to common grasses.*** C.A. Sinker. 1988. No ISBN.

OP34 ***Lichens and air pollution.*** Key by Frank S. Dobson, colour plates by Claire Dalby. Not dated. ISBN 0 85546 234 4.

OP39 ***The freshwater name trail. A key to invertebrates of ponds and streams.*** Richard Orton and Anne and John Bebbington. 1995. No ISBN.

OP42 ***Describing flowers: a guide to the structure of flowers and to their identification features.*** Anne Bebbington and John Bebbington. 1996. No ISBN.

OP43 ***Key to plants common on sand dunes.*** Sally Edmondson. 1997. No ISBN.

OP45 ***Lichens of rocky shores.*** Key by Frank S. Dobson, colour plates by Claire Dalby. 1997. ISBN 0 85546 247 7.

OP46 ***A key to plants common on moorlands.*** Cory Jones. 1998. No ISBN.

OP48 ***A guide to the butterflies of Britain.*** Illustrations by Richard Lewington, text by John Bebbington. 1998. No ISBN.

OP49 ***A key to British land mammals.*** Text by Simone Bullion, illustrations courtesy of Reader's Digest (1984). 1998. No ISBN.

OP50 ***A key to plants common in woodland.*** Text by Richard and Mavis Gulliver, colour illustrations by Carol Roberts. 1998. No ISBN.

The Field Studies Council has produced this new series of identification guides in the form of well-illustrated fold-out charts designed for use in the field. Each chart is produced in a weather-resistant laminated plastic finish and is of a convenient working size.

The charts can be divided into five groupings for the purposes of this review. Firstly, the two 'name trails' (OP32 and 39), are introductory guides designed for children at late primary or early secondary level. They allow for the identification of such 'broad-brush' animal groups as 'water beetles' or 'centipedes', for example, by means of a simple, illustrated dichotomous key. A brief account of each animal group is given on the reverse side of the chart. The woodland trail chart includes a simplified foodweb for minibeasts in soil and leaf litter and an introduction to the woodland food cycle and the role of leaf-litter invertebrates. The freshwater trail chart discusses adaptations for freshwater life and the use of a biotic index to measure levels of pollution. Both of these charts worked well in practice and were popular with the children I tried them out on.

The second group of charts (OP43, 46 and 50) cover the identification of plants from different habitats: sand dunes, moorlands and woodlands. These are designed for more-advanced students.

Each contains keys which are usefully based on vegetative characters and should therefore be applicable at most times of the year, even when the plants are not in flower. As with all such habitat-based keys, it is inevitable that users will find plants that are not covered by the guides and it is important, as the text suggests, that the keys are used in association with a more-comprehensive flora. The woodland key, for example, rather surprisingly omitted broad-leaved willowherb *Epilobium montanum*, a very common woodland plant. The majority of the plants mentioned in the keys are depicted in flower or fruit by coloured illustrations. These vary greatly in quality, those for woodlands and moorlands being far superior to those for sand dunes. The latter are based on Stella Ross-Craig's incomparable *Drawings of British plants*, but they are only pale imitations of the originals and, in the case of white clover, the original image appears to have been manipulated for design purposes such that one inflorescence is shown attached immediately beneath the leaf — an arrangement never found in nature! The illustration of sand couch appears to have been based on a line drawing from Hubbard's *Grasses* but, again, the image has been manipulated to allow it to fit on the page and a false impression is given of the grass as a consequence. The sand dune key seems to have undergone less editorial scrutiny in other respects. The legend identifiers for sea lyme grass and marram grass have, for example, been transposed in the key and *Leymus* is misspelt under its illustration.

Two charts are devoted to lichens, one (OP34), covering their well-known use as indicators of sulphur dioxide air pollution and the other (OP45), giving an account of their distribution on rocky shores. Both these charts are well produced and beautifully illustrated in colour to show the general form of the lichens and, most importantly, details of their intricate fruiting bodies. Both have dichotomous keys written by Frank Dobson which are refreshingly free of technical jargon. The chart on lichens and air pollution should be of particular interest to LNHS members, allowing them to correlate changes in lichen distribution with fluctuations in SO_2 levels in the London area.

Three further charts are designed to enable students to identify species from contrasting groups of British plants and animals: common grasses (OP33), butterflies (OP48), and land mammals (OP49). I found that these all work well in the field, although each takes a different approach. The grasses chart has been adapted from an earlier Field Studies Council publication, *A lateral key to common grasses*, by C. A. Sinker. The key was designed for use in lowland Britain and excludes chalk grassland. The user is asked to examine the grass he wishes to name for the presence or absence of a total of eighteen separate morphological characters. This process results in a unique 'formula' for each of thirty common grasses. As eleven of the characters relate to the structure of the flowers, grasses can only be named when they are flowering. I have tried out the key at Railway Fields and found it works well. However, narrow-leaved meadow-grass *Poa angustifolia* and flattened meadow-grass *Poa compressa*, widespread and frequent (though under-recorded) species in lowland Britain, both keyed out to smooth meadow-grass *Poa pratensis*. The opportunity to bring the nomenclature up to date has been missed and scientific names continue to be taken from Clapham, Tutin and Moore, *Flora of the British Isles*, third edition (1987), rather than Clive Stace's *New flora of the British Isles*, second edition (1997). The outstanding feature of 'A guide to the butterflies of Britain' (OP48), is its superb illustrations. These are reproductions of Richard Lewington's original paintings depicting the fifty-eight species that are most likely to be seen (only extreme rarities are omitted). Details of the undersides of the wings are shown wherever these are required for identification, and the variations between male and female individuals of the same sexually dimorphic species are also clearly shown. Users of this guide should have little difficulty in distinguishing most of the butterflies depicted, with the possible exception of the small and Essex skippers and the pearl-bordered and small pearl-bordered fritillaries, where the differences are small and rather subtle. The publishers sensibly recommend using the chart in conjunction with a good field guide. The reverse side contains some useful information on different aspects of butterfly ecology and conservation. 'A key to British land mammals' (OP49) omits bats, seals and offshore island species such as the Scilly shrew and the Orkney vole, but illustrates thirty-six other species covering insectivores, rodents, carnivores, rabbits and hares, and deer. The illustrations are accompanied by written descriptions highlighting distinguishing features and giving brief notes about habitat and distribution. I found this a particularly helpful guide which has for example, at last enabled me to separate the house mouse (small eyes and uniformly brownish-pink tail) from the wood mouse (very large eyes with tail darker above than below).

The final chart (OP42), on describing flowers is, in effect, an illustrated botanical glossary. It describes the basic structures of a plant and the terms most commonly used in its identification. This should prove invaluable for the beginner who is all too often put off using a botanical key by the obscure technical 'jargon' employed. I found it helpful and reasonably comprehensive, though definitions of the term 'peduncle' (the stalk of a group of two or more flowers), and 'entire' (smooth edged, not toothed or lobed) were strangely omitted.

These charts are, in summary, an extremely useful new series of identification guides which, with the few reservations mentioned, should be widely welcomed by individual naturalists and all those involved in field-based environmental education.

David Bevan

The terrestrial 'sandhopper' amphipod *Arcitalitrus dorrieni* and other invertebrate oddities from Battersea Park

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Summary

The terrestrial amphipod *Arcitalitrus dorrieni* is reported from Battersea Park, along with two nationally rare (*Red data book*) and nine nationally scarce (Notable) insects. They were all collected during a brief survey of three 'nature areas' left more or less wild. Although the Park is generally very dull from a natural history point of view, these three scrubby bits of secondary woodland show some promise for wildlife interest.

Introduction

During 1998, I was asked by the London Wildlife Trust's conservation work arm to examine the invertebrates in three small sections of Battersea Park which the Trust manages as 'nature areas' for the London Borough of Wandsworth. The aim of the survey was to assess the invertebrate interest of the sites and advise on their management.

The three nature areas are described in detail in a recent management plan (Scott 1998). Briefly, they comprise: 'The Meadow', a circular belt of mixed woodland and scrub surrounding a small open piece of rough grassland; 'The Wilderness', a narrow linear plantation of mixed trees and scrub running north to south on the eastern edge of the Park with three small west-facing glades; 'Rosary Copse', a small circular woodland, recently part coppiced in the middle. They are all contained within 1-km square TQ2877, tetrad TQ27Y, vice-county 17 Surrey.

Even though the three areas are small and compact, such a superficial survey (three visits during the year), could only hope to give a very preliminary result — enough for a 'feel' for the places, maybe, and a vague idea of their natural history worth. In the event, however, a list of 135 species was compiled, including several nationally scarce and other extremely interesting species (Jones 1998). Perhaps the oddest find was the terrestrial amphipod *Arcitalitrus dorrieni*.

A landhopper far from home

Arcitalitrus dorrieni (Hunt) is in the amphipod family Talitridae. It is very closely related to the freshwater shrimps, *Gammarus* species, and the sandhoppers, *Orchestia* and other species, so commonly found under seaweed on sandy beaches or under stones on rocky shores. It is very similar in having the same characteristic hunched, laterally flattened form and moves by the same rapid skipping movement. This is a large group with many difficult-to-identify species, but *Arcitalitrus* is almost immediately recognizable because it is the only truly terrestrial member of the group in Britain, occurring well away from fresh and salt water, in the microhabitat usually fully occupied by woodlice.

I had come across it once before, in the garden of a holiday cottage near Land's End, so knew instantly what I had uncovered when dozens of them skittered out from under a sawn log on the northern shaded side of The Meadow on 4 June 1998. They were equally plentiful on a return visit on 1 July 1998. Many more made a similar escape when I rolled over a small log in The Wilderness on 1 November 1998. Their identity seemed almost certain, but because there are other terrestrial amphipods established occasionally on heated glasshouses, I sent them to the recording scheme at the Institute of Terrestrial Ecology for confirmation.

Arcitalitrus is a curious creature; it was first described, new to science, from the Isles of Scilly in 1925. It is, in fact, a native of Australia, where other similar terrestrial amphipod species are widely known. It was presumably introduced into this country in soil with plant specimens shipped from the southern hemisphere. At about the same time it was also introduced into the Inner Hebrides and Ireland. It has spread to inhabit leaf litter and is now distributed within about fifteen miles of the coast through Cornwall, Devon, the Channel Islands and south-west Ireland (Harding and Sutton 1988). The only outlying localities, until recently, were Colonsay, Galway and London's Kew Gardens, where a single specimen was discovered in leaf litter in 1980 (Welch 1981).

It seems reasonable to conclude that *Arcitalitrus* was somehow introduced into Battersea Park in soil, leaf litter or other horticultural material, rather than by its own means. Its 'natural' spread in the West Country is estimated to occur at a maximum rate of 30–40 metres per night, but it is difficult to imagine how such a creature could cope with crossing urban tarmac-coated London from one green island to another without help from one human agency or another moving plants and soil from place to place.

There is already such a trafficking operation between London's parks and Kew Gardens. It transpires that fallen leaves, collected by the ton each autumn, are taken by the lorry-load from the parks to be composted in giant heaps at Kew. It is by this route that the minute moth *Phyllonorycter platani* is thought to have first arrived at Kew, in its mines in the fallen leaves of London plane trees, collected for mulching (Emmet 1991). However and whenever *Arcitalitrus* arrived in London it was almost inevitable that before very long it would turn up at Kew. Similarly, with the mass movement of fallen leaves each year, it is certainly not beyond imagination that *Arcitalitrus* ought to occur elsewhere in the capital. Indeed, it has already been found at the Camley Street Nature Park, King's Cross (Mathew Frith, London Wildlife Trust, pers. comm. 1998).

A good place for oddities

Along with *Arcitalitrus,* several other unusual finds were made in Battersea Park. On 1 July 1998, under the same cut sections of the log in The Meadow, were several specimens each of two blind subterranean beetles, *Anommatus duodecimstriatus* (Müller), and *Langelandia anophthalma* Aubé, and a single specimen of the 'dung' beetle *Saprosites mendax* Blackburn.

Anommatus duodecimstriatus is a minute beetle (family Cerylonidae), currently regarded as being nationally scarce (Notable A, Hyman and Parsons 1992). It is a widespread but very local species recently recorded from only a very few localities, however, it is mainly subterranean in habit (it lacks eyes) and is probably easily overlooked. It is fairly widespread in the London area and is known from Bromley, Lewisham and Epsom.

Langelandia anophthalma, another minute beetle (Colydiidae) is currently listed as nationally rare (*Red data book* category 3, Hyman and Parsons 1992). Again, it is very local, but possibly overlooked because it too lacks eyes and is mainly subterranean. It was first found in Britain in seed potatoes in Kent in 1886, and for many years it was known only from a few scattered localities in that county. In the last half of this century it has also been recorded in Sussex, Devon, Cornwall and Berkshire (Hyman and Parsons 1992), and more recently in abundance in a garden in Epsom, Surrey (Owen 1997) and Buckingham Palace Gardens, Westminster, Middlesex (R.A. Jones, unpublished).

Saprosites mendax Blackburn is a minute 'dung' beetle (Scarabaeidae) which has nothing to do with animal droppings. Like *Arcitalitrus,* it is an Australian species accidentally introduced into England. It was first discovered here in Arundel Park, West Sussex, in 1930, reputedly in the borings of the lesser stag beetle *Dorcus parallelipipedus* (Linnaeus) and the least stag beetle *Sinodendron cylindricum* (Linnaeus). For many years it was confined to this small area of the country, but has recently been found in Richmond Park and 'West London' (Jessop 1986). Battersea Park is therefore the fourth recorded British locality for this beetle, although it also turned up this year, a few days earlier, in a flight interception trap at Highgate Wood, Middlesex (Hackett, in press). The association with the frass-filled burrows of wood-boring beetles is not often cited nowadays, and *Saprosites* is more often found just simply 'associated' with logs, especially cut surfaces.

Sycamore logs, not such an unlikely habitat

As in several other London localities, sycamore logs once again provided a habitat for several unusual beetle species. *Cicones undatus* Guérin-Méneville, *Diplocoelus fagi* Guérin-Méneville and *Enicmus brevicornis* (Mannerheim) all occurred under the bark of sycamores killed by the sooty bark disease, a fungus *Cryptostroma corticale.* Logs and trunks affected by the disease are covered with a layer of characteristic black soot-like smut, and this specific habitat has been colonized by the beetles only fairly recently — the fungal disease first became common in England in the 1950s. It is particularly prevalent in the London area and breaks out especially after hot dry periods. A number of unusual beetles are now regularly associated with the disease, especially in London (Jones 1993, 1996*a,* in prep.).

Cicones undatus is a minute chequered fungus beetle (Colydiidae). Many were found under the bark of diseased sycamore logs throughout the area, 4 June 1998, 1 July 1998, 1 November 1998. It was originally accorded 'endangered' status (*Red data book* category 1, Hyman and Parsons 1992). At the time of that review, it was known only from a handful of dead sycamores in Windsor Great Park and was thought to be an ancient woodland relic species associated with maples. It has since been shown to be common and widespread in the London area (Jones 1993, 1996*a*), but it is still very local in a national context. However, its status obviously requires reassessment.

Diplocoelus fagi is a minute brown fungus beetle (Biphylidae). Several were found under the bark of diseased sycamore logs throughout the sites. Although currently regarded as being nationally scarce (notable B, Hyman and Parsons 1992) and an ancient woodland 'indicator' species (Harding and Rose 1986), this beetle has recently been found fairly frequently elsewhere in the London area associated with sycamores infected by *Cryptostroma* (Jones, in prep.).

Enicmus brevicornis is a minute black mould beetle (Lathridiidae). Many were found under the bark of cut sycamore logs infected with the disease throughout the sites, 1 July 1998 and 1 November 1998. Like *Diplocoelus, E. brevicornis* is currently listed as nationally scarce (Notable, Hyman and Parsons 1994) and is regarded as an ancient woodland indicator (Harding and Rose 1986). However, it too is very common and widespread in the London area, where it is associated with sycamores infected with *Cryptostroma* (Jones 1993 and in prep.).

Other unusual and uncommon species

Other interesting insects found in the nature areas included the following uncommon species. *Agrilus sinuatus* (Olivier), is a small pink jewel beetle (Buprestidae, Notable A, Hyman and Parsons 1992); the characteristic exit holes and sinuous borings were found. It was originally accorded vulnerable status (*Red data book* category 2, Shirt 1987), but this was reduced to Notable A when it was shown that the burrows and exit holes were much more widespread than was previously thought — they are fairly frequently encountered on old hawthorns in south London. *Athous campyloides* Newman is a medium-sized brown click beetle (Elateridae, Notable B, Hyman and Parsons 1992). Two were swept in Rosary Copse; it is associated with rough grassy areas where it is thought to feed at plant roots. *Platyderus ruficollis* (Marsham) is a small orange-brown ground beetle (Carabidae, Notable B, Hyman and Parsons 1992). Several were found under logs; it is generally associated with sandy and chalky soils, but is fairly widespread in the London area (Luff 1998). *Scolytus mali* (Bechstein), is a small bark beetle (Scolytidae, Notable B, Hyman and Parsons 1992). Two dead specimens were dug out of an old *Prunus*(?) tree. *Lasius brunneus* (Latreille) is a small brown ant (Formicidae, Notable A, Falk 1991*a*), many specimens representing a number of small nests in and under logs throughout the sites. It is confined to central England, in particular the Thames and Severn Valleys, and appears to have been spreading since it was first recorded as British in 1923 from Berkshire. It has recently been found in south-east London, at Dulwich (Jones 1997), Beckenham and Charlton (Jones 1996*b*). *Volucella zonaria* (Poda), is a very large hornet-mimic hoverfly (Syrphidae, Notable, Falk 1991*b*), now common and widespread in London.

Conclusion

Battersea Park is generally a very poor natural history site, except for the presence of three small 'nature areas'. Within these small woodland and glade habitats a number of very interesting invertebrate species were found, including several nationally scarce (Notable) species and two nationally rare (*Red data book*) species. Some, like the amphipod *Arcitalitrus dorrieni* and the 'dung' beetle *Saprosites mendax,* both native to Australia, have presumably been introduced by human agency, but others are obviously natural inhabitants of the Park. It is heartening to find that even relatively scrubby bits of secondary woodland, in what is virtually central London, can still have some unusual and uncommon species providing a diverse natural history interest amongst the environmental deserts of closely cropped grass lawns and sports fields.

Acknowledgement

Jenny Cowling, of the Institute of Terrestrial Ecology, kindly confirmed the identification of *Arcitalitrus dorrieni.* She would welcome further records, with any specimens preferably in 70 per cent alcohol, at ITE, Monks Wood, Abbots Ripton, Huntingdon PE17 2LS.

References

EMMET, A.M. 1991. *Phyllonorycter platani* (Staudinger, 1870) (Lepidoptera: Gracillariidae) new to Britain. *Entomologist's Rec. J. Var.* **103**: 1.

FALK, S. 1991*a*. *A review of the scarce and threatened bees, wasps and ants of Great Britain.* Nature Conservancy Council, Peterborough.

FALK, S. 1991*b*. *A review of the scarce and threatened flies of Great Britain. Part 1.* Nature Conservancy Council, Peterborough.

HACKETT, D. In press. [*Saprosites mendax* from Highgate Wood. Exhibit at British Entomological and Natural History Society annual exhibition, 31 October 1998]. *Br. J. Ent. nat. Hist.*

HARDING, P.T. and ROSE, F. 1986. *Pasture-woodlands in lowland Britain: a review of their importance for wildlife conservation.* Institute of Terrestrial Ecology, Abbots Ripton.

HARDING, P.T. and SUTTON, S.L. 1988. The spread of the terrestrial amphipod *Arcitalitrus dorrieni* in Britain and Ireland: watch this niche! *Isopoda* **2**: 7–10.

HYMAN, P.S. and PARSONS, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain. Part 1.* UK Nature Conservation No. 3. Joint Nature Conservation Committee, Peterborough.

HYMAN, P.S. and PARSONS, M.S. 1994. *A review of the scarce and threatened Coleoptera of Great Britain. Part 2.* UK Nature Conservation No. 12. Joint Nature Conservation Committee, Peterborough.

JESSOP, L. 1986. Dung beetles and chafers. Coleoptera: Scarabaeoidea. *Handbks Ident. Br. Insects* **5**(11) (Ed.2).

JONES, R.A. 1993. Sycamore: an underrated pabulum for insects and some beetles associated with it. *Entomologist's Rec. J. Var.* **105**: 1–10.

JONES, R.A. 1996*a*. *Cicones undata* Guér.-Mén. (Coleoptera: Colydiidae) still common under sycamore bark in South East London. *Br. J. Ent. nat. Hist.* **9**: 91–92.

JONES, R.A. 1996*b*. *Lasius brunneus* (Latreille) (Hymenoptera: Formicidae) new to Kent? *Br. J. Ent. nat. Hist.* **9**: 135–136.

JONES, R.A. 1997. *Sydenham Hill Wood, Dulwich Wood and Cox's Walk: relic woodlands in south-east London. An invertebrate survey.* Unpublished report for the London Wildlife Trust.

JONES, R.A. 1998. *Battersea Park nature areas: a preliminary invertebrate survey.* Unpublished report for the London Wildlife Trust.

JONES, R.A. In prep. Further notes on the beetles associated with sycamore and its sooty bark disease.

LUFF, M.L. 1998. *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain.* Biological Records Centre, Abbots Ripton.

OWEN, J.A. 1997. Observations on *Raymondionymus marqueti* (Aubé) (Col.: Curculionidae) in north Surrey. *Entomologist* **116**: 122–129.

SCOTT, A. 1998. *Management plan for Battersea Park nature areas.* Unpublished report for London Conservation Services and London Wildlife Trust.

SHIRT, D.B. (ed.) 1987. *British red data books*: **2**. *Insects.* Nature Conservancy Council, Peterborough.

WELCH, R.C. 1981. *Talitroides dorrieni* (Hunt) (Crustacea: Amphipoda) in the Royal Botanic Gardens, Kew, Surrey. *Lond. Nat.* **60**: 43–44.

Book review

The history of British mammals. Derek Yalden. Illustrated by Priscilla Barrett and the author. Poyser Natural History Series, T. & A. D. Poyser Limited, London. 1999. 305 pp. £29.95. ISBN 0 85661 110 7.

This new book, by one of our Society's long-standing members, is the latest in a series which has become well known to all active mammal workers. Previous works on British mammals in this series have included monographs on mink, hedgehogs, badgers and long-eared bats. Each of these works has been produced to the very high quality expected from such an established publisher and they have all become the standard reference texts written by well-known experts.

With such an established pedigree, this new publication has a lot to live up to. That it has succeeded, even exceeded, the benchmarks set by these past works is a tribute to Derek Yalden's unrivalled extensive knowledge of the subject and his skilful writing style — a combination not present in every author! It is a great shame that there are competitions for the 'Best Bird Book of the Year', but no equivalent for mammals; for this book would surely take any 1999 prize, leaving all other competitors far behind.

The stated objective of the book is 'to describe how the British Isles obtained the mammal fauna they have at the end of the 20th century'. To achieve that aim, the author starts with the very beginning of mammalian history itself, before moving through the Tertiary period and up to the recent glaciations. The bulk of the book then concentrates on the period following the end of the Devensian glaciation and continues right up to the end of the present century.

Diverse topics such as the changing agricultural landscape throughout history, land bridges, changing climate, introduced species, hunting and much more are all covered in detail. In fact, if something has affected our mammal fauna you will surely find it discussed in this book. There is a useful concluding section discussing the future of our mammals into the next millennium and for readers requiring to check the original sources of data, there is also an extensive twenty-four page reference section.

Although written from a national perspective, the reader will find numerous interesting references to the past fauna in the London Area. There are the hippopotamus and lion bones from Trafalgar Square, woolly rhinoceros from Crayford and polar bear from Kew to discover amongst its pages, together with reminders of the more recent grey squirrel introduction sites in west and central London at the turn of the century.

In summary, this is a book which everyone interested in British mammals will require on their shelves and it will, no doubt, achieve a deservedly wide readership among more general naturalists. This book will remain a standard reference text long into the next century and, in addition, solve the problem of what to give your fellow naturalists next Christmas. There are only a limited number of superlatives which any reviewer can reasonably use in an article — the trouble with this book was to decide which ones to omit from my comments.

CLIVE HERBERT

Book review

The Myxomycetes of Britain and Ireland. An identification handbook. Bruce Ing. Richmond Publishing Co. Ltd., Slough. 1999. 374 pp. £35. ISBN 0 85546 251 5.

As the publisher's write-up says, this book is the long-awaited outcome of Bruce Ing's forty years of enthusiasm for slime moulds, and very welcome it will be to anyone who has felt an urge to name and find out more about one of these mysterious objects.

The introduction begins by explaining the results of modern techniques in placing these extraordinary organisms in the scheme of life as Protista (or Protozoa) that have become colonial, lost their individual cell walls, and so achieved that creeping mobility of the whole colony that enables them to seep through wood and over other media in search of bacterial food, and to appear as though by spontaneous generation to form strange sporulating structures. The life cycle and terminology of structures used to identify the species are illustrated by the author's simple line sketches.

A chapter on ecology and distribution gives good guidance on the habitats favoured by myxomycetes and the living substrates which they favour. 'Collection, culture, examination and preservation' gives concise instructions on those topics. I found the instructions a bit too concise and at this point began to question the publisher's claim that no previous knowledge of the group was required to use the book, of which more later. The volume concludes with a glossary, bibliography, index to species listed under genera, and a list of museum herbaria (not all curated by experts to whom one could turn for help) and a few organizations.

A key to families opens the bulk of the book, which is arranged in descending taxonomic order. A concise diagnosis of a family is followed by a key to genera. Each genus is given a diagnostic description, followed by a key to species. Species are described according to a standardized sequence of features of plasmodium (the creeping stage), sporocarp (the usually upright reproductive stage) and the individual spores. There are very simple line sketches of these items wherever they are distinctive. Only the spore diagrams are intended to convey surface features. The diagrams bear scale lines, but these give no impression of size when scanning through the book, so I failed to pick out that large species of tree trunks, *Enteridium (Reticularia) lycoperdon* (Bull.) M. L. Farr, with its silvery, papery envelope that pours out spores like half a puffball.

I searched my local woodland for sample myxomycetes to test the keys. I found very few mature specimens on dead wood and none on tree trunks. Immature sporocarps, just differentiating, were attended by static Collembola, probably waiting to feast on the spores. Specimens viewed at midnight had disappeared in the morning, almost certainly having been predated by tiny slugs and snails lurking between the wood fibres. As the prevalent situation was on the end-grain of rotten wood, which is not easy to detach from a log without it crumbling, many specimens are likely to be lost by the beginner.

The keys consist of very simple couplets and look encouragingly easy to use. There are however snags for the beginner. One species, where colour of the spore mass was used, had a plum-red colour in the fresh, damp specimen, with a few, apparently undamaged sporangia nearly black, but the dry spore mass, as it might have appeared in a collection, was pale, slightly pinkish grey. Some species have a fugitive pericardium (the outer skin), so that its detection depends critically on the state of maturity of the specimen. The pattern of the capillitium (an internal web of threads) is much used, but hard to discern if the simple instruction to squash a sporangium on a slide in Hoyer's gum chloral is followed. Some technique for dispersing most of the spores first is needed.

The diagrams of spores are crude representations of what is seen through a ×400–×1,000 optical microscope, which presents an optical section of a spherical object. To interpret the view in terms of the described surface pattern, at least a representative selection of scanning electron micrographs of common species would be helpful. Pollen grains present a similar situation.

Whilst I thought that I was getting close to the correct genus with my first attempts, judged by the simple outlines of sporangia, I would certainly need a selection of reference specimens and some expert confirmation of my determinations of unknown species before I would dare to pronounce that I had recorded even common species.

Sadly, the only illustrations of live myxomycetes are of six species on the laminated front cover of the book, not even reproduced as a frontispiece. I understand that it was originally planned to reproduce the illustrations from Lister's world monograph on myxomycetes, but that The Natural History Museum Library, which holds the originals, wanted a large sum of money for reproduction, which would have put the price of the new book out of reach for practising naturalists and straight into the antiquarian category. The result is that the Museum gets nothing and the figures are still to be found only in a volume that is long out of print. Is this how we should make our national scientific institutions run?

Most importantly for a key work, the hard-covered binding opens flat and has wide central margins. It is well laid out and seems as free of misprints as makes no difference. The price is not unreasonable for a commercially produced, highly specialized book. Well done, Bruce and all at Richmond Publishing for producing this long-awaited monograph. May it stimulate a much larger band of dedicated enthusiasts, but field guide, or starting point for the enquiring beginner it is not.

R.W. J. Uffen

A survey of the stag beetle *Lucanus cervus* in south London during 1997

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Abstract

A public survey was undertaken during 1997 to ascertain a more updated picture of the distribution of the stag beetle in south London, in preparation of Local Biodiversity Action Plans. The survey, organized by London Wildlife Trust with assistance from Bromley Council, resulted in many new records, helped to promote the public's awareness of the beetle and its habitats, and laid foundations towards the national survey of the species in 1998.

Introduction

The stag beetle *Lucanus cervus* (L.), Britain's largest terrestrial beetle, is a globally declining species. It is protected in Europe, and in 1998 received protection from sale in the UK under Schedule 5 of the Wildlife and Countryside Act, 1981 (as amended). On this basis it is listed as a priority species under the UK Biodiversity Action Plan (UK Steering Group 1995). Earlier records and surveys (e.g., Donisthorpe 1941, Lewis 1941, Clark 1966) have demonstrated a distribution focused primarily in southern and south-east England, in particular the New Forest, the Thames Valley and eastern Essex/Suffolk. Evidence suggests that although its range in Britain has declined significantly since the 1940s, particularly from its western and northern extremities, for some reason it still appears to be relatively common in London. The significance of the capital to its national population has led to the stag beetle being listed a candidate priority species for the London Biodiversity Action Plan and a number of borough Local Biodiversity Action Plans. Its distribution in the London area, however, is not even throughout or confined just to the areas of ancient woodland and wood pasture where there is usually a predominance of large dead wood. Earlier papers in *The London Naturalist* (Hall 1961, 1964) have shown that its distribution is skewed to the south and the west (Figure 1), although some of the records shown may not be accurately placed as the location name given was too general.

Most of the stag beetle's life is hidden from view. With up to seven years spent deep within the heart of a log or tree stump, the creamy-white larva grows slowly on the low-nutrient nourishment of the dead wood around it. After some four to five years it moves towards the base of a stump and matures into a pupa. The adult emerges from mid May to July (the males first) when it can often be found flying clumsily in balmy sunny summer evenings, often colliding with vehicles, buildings and trees. In London stag beetles can be found in woods, parks, and gardens, as well as crawling on pavements and roads. Occasionally they are reported from more unusual locations such as Thames river walls (Richard A. Jones, pers. comm.) and even under a bed! As adults they usually live for about four to seven weeks, as males seek females to complete their life cycle. The eggs are always laid singly in dead or decaying wood, including the bottom of fence

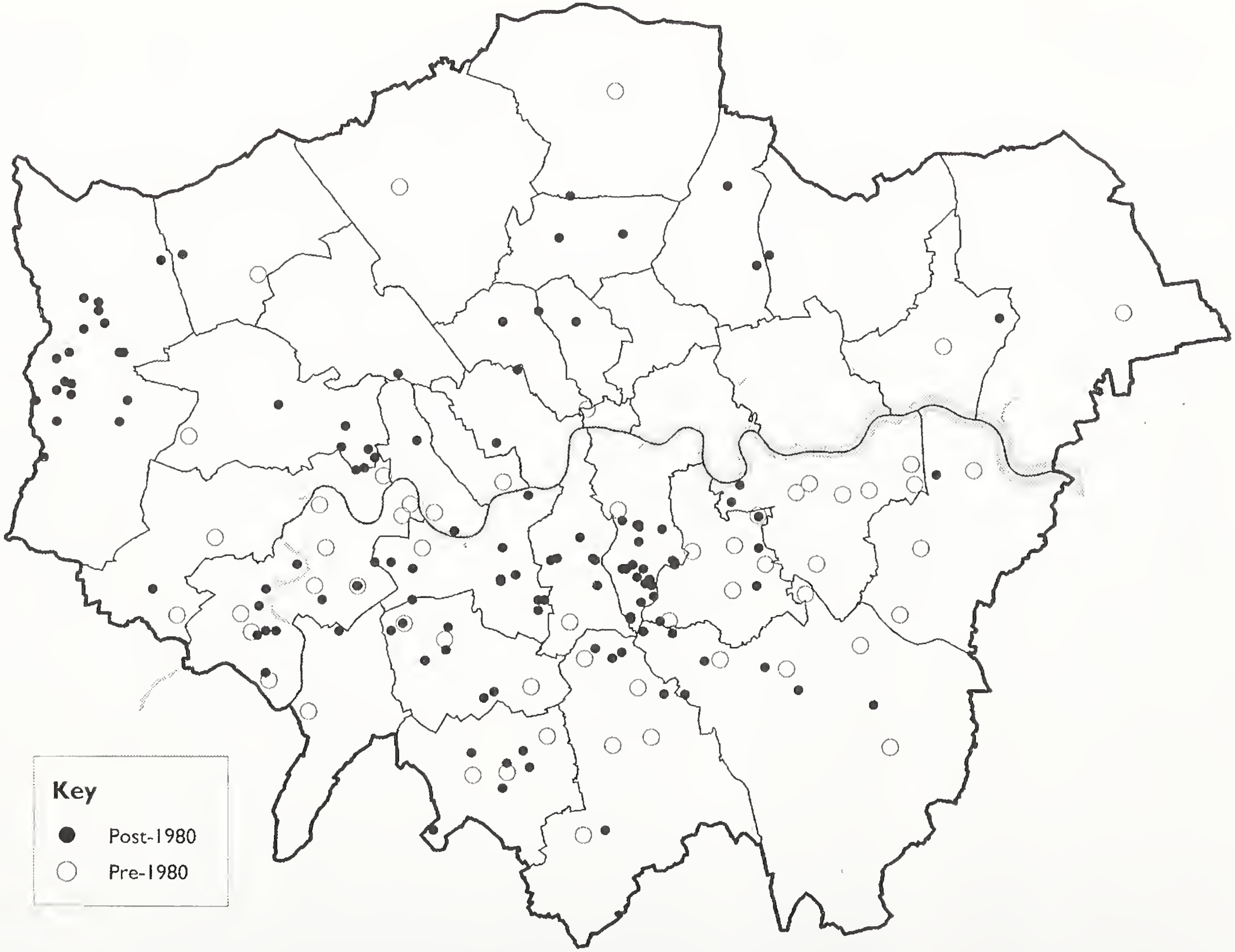

FIGURE 1. Records of stag beetles from LNHS prior to 1997. Based upon Ordnance Survey mapping on behalf of the controller of Her Majesty's Stationery Office. © Crown Copyright. Licence No. AL51733A0001. Produced by the London Wildlife Trust's Biological Recording Project.

posts. Some adults overwinter deep in leaf-litter or even compost heaps. Little else is known of the adults' habits. What they feed on — if they need to feed at all in the wild (sap runs have been suggested, although they can be kept on honey in captivity), and what makes them choose the sites (e.g., which tree species) the females lay their eggs in — has still to be ascertained.

We do know, however, what kills the adults. As large, slow and poor flyers they are easy prey to domestic cat, fox, magpie, crow and kestrel, as well as the unwitting victims to vehicles and human feet, and deliberate crushing. Many drown in garden ponds and water butts. Of greater impact has been the destruction of their larval food source — dead wood — through the ritual tidying of woods, parks and gardens courtesy of stump grinders, excavators, wood-chippers and winches, and the loss of their wider habitat through development. This, it appears, has been considered to be the greatest contribution to the beetle's decline.

As part of London Wildlife Trust's contribution to the local Biodiversity Action Plans for Bromley (Bromley Wildlife Partnership 1998) and Southwark (Frith 1997), the Trust piloted a survey of the stag beetle in south London during 1997. The beetle was chosen because of its apparent distribution south of the Thames and relative ease of identification. As a species subject to both the UK and London Biodiversity Action Plans, data collected at a local level have significant regional and national interest.

Methodology

The survey consisted of asking Trust members in Bromley and Southwark and to a wider public in south London to record their sightings on a simple form, either available from the Trust, or through libraries and direct mailing. The form asked people to note when and where they saw stag beetles, and any other information which they felt appropriate. A similar form was distributed by Bromley Council to run parallel to that of the Trust (Bromley Wildlife Partnership 1997). Complementary to this the survey received good press coverage; all local papers in south London were targeted.

Most earlier surveys have been undertaken by entomologists and those with more than a basic knowledge of insects. This, in contrast, was first and foremost a public survey, with the dual purpose of gaining new records and informing people of the importance of stag beetles and their habitat. Acknowledging the potential for mis-identification, the form featured illustrations of not just male and female *Lucanus cervus,* but also lesser stag beetle *Dorcus parallelopipedus,* cockchafer *Melolontha melolontha* and violet ground beetle *Carabus violaceus* as species people may have encountered. The form allowed for sightings of *Dorcus* to be included.

During the progress of the survey, we became aware of other surveys of the species recently carried out, in Wandsworth (Turtle 1997) and Colchester (Bowdrey 1997) in 1996, and a garden wildlife survey of Croydon which specifically asked for stag beetle sightings (Jennings 1997). All these also relied on the public as the primary source for records rather than existing experts. We were also invited to be involved in the preparation for the national survey in 1998 (see below).

Results

Over 600 forms were sent out, and over 200 responses received, resulting in over 400 individual beetle sightings. Dubious records were separated out, and the rest were sorted into clear male *Lucanus,* female *Lucanus, Dorcus,* and 'stag beetle'. These were mapped on the Trust's GIS/MapInfo system and entered onto Recorder. The results from the Bromley survey forms, as well as the Croydon garden and Wandsworth surveys were also mapped (Figure 2).

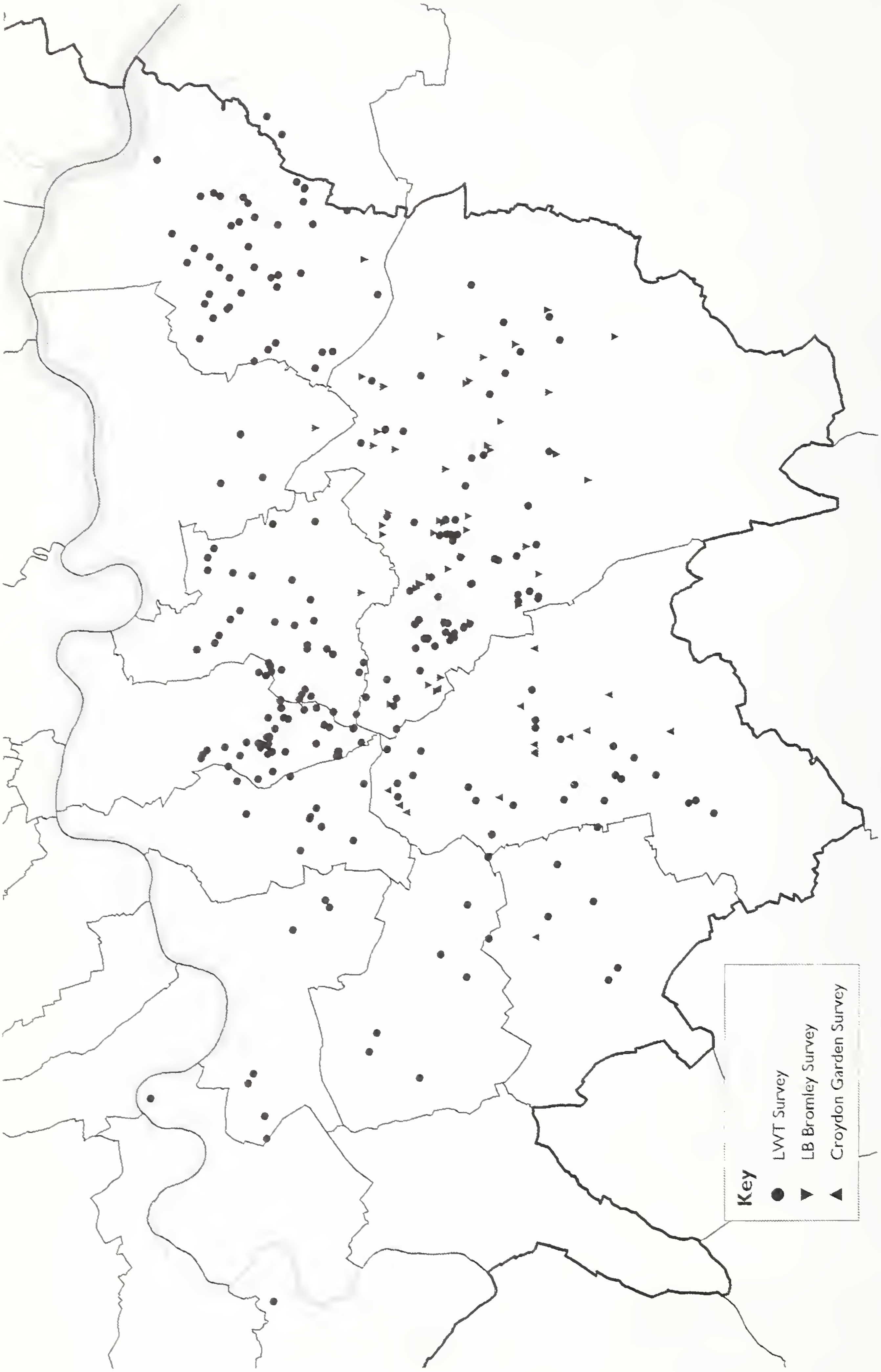

FIGURE 2. Records of stag beetles, 1997. Based upon Ordnance Survey mapping on behalf of the controller of Her Majesty's Stationery Office. © Crown Copyright. Licence No. AL51733A0001. Produced by the London Wildlife Trust's Biological Recording Project.

The survey demonstrated a broad swathe of recordings right across south London, but tending towards the south-east. The low-lying flood plain of the Thames was almost devoid of records, as was the more rural Green Belt to the south. However, this may not be a reflection of the occurrence (or not) of stag beetles. The Green Belt has fewer people living in it, and thus the survey may not have reached these. The survey was also concentrated towards the south-east London boroughs (helped by the press coverage), which will also thus tend to explain this skew — front page coverage in Bexley helped a particular number of records to come forth from there. One record came from northern France.

Despite these constraints, there does appear to be strong concentrations of records in two particular areas — Beckenham and Camberwell/Dulwich. The latter is well known for its stag beetles — the Dulwich Society has been recording them for a number of years, much helped by its large amount of open green space, woodlands and old trees. Beckenham's data are less well understood, but may be just down to a good response to the two survey forms in tandem. It is clear that large and relatively old suburban gardens (pre-1914) are a significant habitat for stag beetles, but to survey these adequately in London will be a huge undertaking — the survey just scratched the surface.

It was clear that the survey generated public interest, and that contrary to many people's belief, some insects can prove popular and engage members of the public towards their conservation. The stag beetle may be a case in point — with not only the number of responses to a relatively cheaply run survey, but from the anecdotes that people forwarded in addition to simple sightings.

Anecdotes

The survey generated considerable interest from the contributors. We received a large number of anecdotes, photographs and details of other sightings, as well as invitations to see the beetles for ourselves (Frith 1998*a*). These made the survey much more than a 'dry' scientific gathering of data into something with a personal and even cultural, relevance. For without the stag beetle 'appealing' to people (in any way) we have a much greater task of conserving it. Many observers told of how many years ago they first saw them, or for how long they have been present in their garden. Others told of the excitement of their first sighting — 'caused us quite a stir!' They were recorded from most rooms of a house — the lounge, kitchen, porch and bedroom! We had descriptions of them 'enjoying a swim' in a water-butt, 'jumping into a pond', being found in a shoe and under the carpet, following someone around the garden, 'dropping out of the ivy' at a barbecue, and 'crashing' into sides of houses. One person told of her rearing two grubs in 1982 in a sweet tin in her garage, and every year since then adults have returned, trying to make their way through the lounge to the same part of the garage. Another beetle was reported flying in one door and out through the front. Others 'clung to the nose' of a cat, 'landed on my leg!', and found on a path 'doing acrobatics'.

Some people had rescued them; from cats, a moth trap and from drainpipes, or overturned them when they had found them stranded on their backs. Others were reported dead — such as 'presumably eaten by a badger', '[eaten] by magpies', and 'quite squashed'. A fox in West Wickham was seen 'chewing a titbit', and upon being disturbed 'spat out whatever he had left in his mouth' to leave 'two stag beetle's horns and a bit of a wing case'.

Many people reported a decline in sightings over the last ten to thirty years — 'almost a plague fifteen years ago!', 'disappointed at seeing so few now'. Some people reported the beetles flying until a particular tree had been blown (e.g., in a recent gale) or cut down. Some could relate this directly to the clearance of wildlife habitat for the development of a car park or new housing. One observer suggested that on summer evenings 'people are more attentive to TVs, driving, pubs, in-house entertainment, clubbing and a whole host of other diversions. Consequently there must be a substantial reduction of walking in parks and woods, even in road walking . . . and after-work gardening activity in the evenings.' This would contribute to an 'apparent reduction in stag beetle sightings that may exceed any actual beetle decline'. There would appear to be some logic to this theory that would be worth testing out.

It was clear that the response to the survey was almost wholeheartedly positive, and that many people were only too keen to help the Trust in future surveys.

Discussion

There were no clear conclusions from the 1997 survey — it was but a 'snapshot' in time, with only a sketchy coverage over some London boroughs. However, it has realized new record sites for the species, many in localities not previously known for their stag beetle interest, and importantly gained some positive publicity for the species laying foundations for the national survey in 1998.

The stag beetle's distribution in London is predominantly in the south and west, in the arc between Bexley – Beckenham – Dulwich – Wimbledon – Richmond – Hounslow, an area noted more for its gardens than ancient parkland, veteran trees and woodlands, although these are present (Frith 1998*b*). Indeed, almost all records came from the built-up areas (where people live) rather than the large open spaces encapsulated within (such as the Oxleas Wood complex and Richmond Park) or the Green Belt on the outer fringes (Figure 3). In contrast the stag beetle appears to be only uncommonly found north of the Thames. The Colne Valley and the upper Lea (where it meets Hertfordshire) are strongholds but it is virtually absent (from records to date) from the Barnet and Harrow areas.

This uneven distribution seems peculiar and requires explanation. The suburban gardens of south London cater for the species by providing large old trees (many encapsulated from the old countryside by development between 1880 and 1940) but also old tree stumps (not ground down or pulled up), wooden fence post, and compost heaps, etc. But these requirements are found elsewhere in London, and some researchers are looking into microclimatic conditions, suggesting that warmer areas are preferable to cooler (Hackett 1997). However, it is doubtful that this alone is a reason for the significant north–south divide in London.

From the records to date the London distribution appears to bear some correlation to underlying geology — there are few records from the alluvials of the Thames flood-plain and the chalk. Indeed, ideas generated through the work of the Stag Beetle Focus Group, suggest that underlying soil conditions may be important factors; free-draining acidic soils, such as Claygate Beds, sands and gravels, being preferable to either London Clay or chalk. However, attempts to correlate sightings with surface geology (Plant 1994) do not seem to accord with this suggestion. One of the south London hotspots for the species, the Dulwich area, is firmly based on London Clay, contrary to these supposed preferences. And the few records gathered from the chalky North Downs could be just a factor of far fewer people being present here, being largely the rural Green Belt. That there are few records on the Thames flood-plain is probably due to lack of adequate habitat rather than one of soil type, although historical factors might also be important. Could there be eco-historical factors involved or anthropogenic factors we are as yet unaware of?

Is the stag beetle in decline in London? The survey suggests that the species is not as rare as in other parts of the country, and is locally common. However anecdotal evidence suggesting higher numbers in the past may reflect an actual decline, although this survey was unable to ascertain this. The loss of wildlife habitats in London has continued apace, but the majority of sites that have disappeared in the last twenty years have been young ruderal habitats and wastelands, grassland or recent woodland, rather than ancient woodlands rich in dead wood. Woodland, and especially parks management in London, has largely been unsympathetic by removing dead wood, both standing and lying, but this is

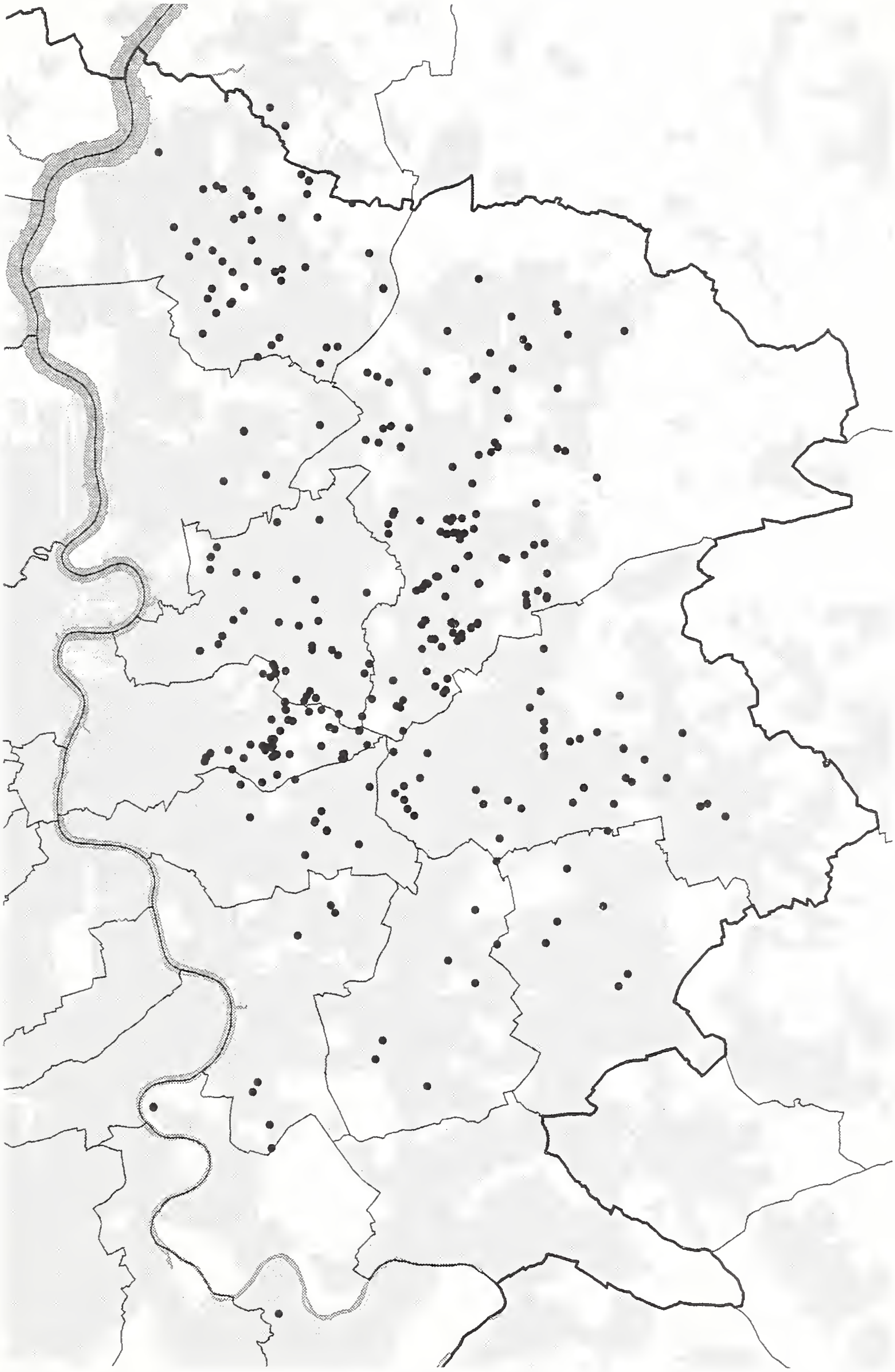

FIGURE 3. Records of stag beetle, 1997; correlation with built-up areas. Based upon Ordnance Survey mapping on behalf of the controller of Her Majesty's Stationery Office. © Crown Copyright. Licence No. AL51733A0001. Produced by the London Wildlife Trust's Biological Recording Project.

not new and has been a feature for most of the twentieth century. In recent years positive changes have led to most woodlands and many parks adopting far more sympathetic management practices, which not only benefits stag beetles but other fauna and fungi dependent upon dead wood. But the adult beetles face a barrage of threats in London which may exert significant and possibly increasing pressure on the species' conservation — not only crushing from feet and cars (hard surfaces may be warm and attract the beetles), but also predation from domestic cat, kestrel and corvids. Indeed, the significant increase of carrion crow and magpie in London over the last fifteen years may pose a threat. The adult beetles emerge at a time when most songbird nestlings are large enough to escape opportune predation from magpie and crow, and are a new source of food. Certainly early reports from the 1998 survey suggest that magpie was by far the most recorded predator. However, as with the concern over corvid predation of songbirds, magpies are visible and noisy predators which people notice; whether they pose a real threat to the viability of stag beetle populations needs to be ascertained by further research.

During 1997 the Stag Beetle Focus Group formed, consisting of entomologists and conservation practitioners from English Nature, The Natural History Museum, the Wildlife Trusts, Corporation of London and other bodies, and administered by the Peoples Trust for Endangered Species (PTES), to correlate information and identify research requirements for the species and its conservation (e.g., Tullett 1998). PTES are the 'champion' of the stag beetle under the UK Biodiversity Action Plan, and ran the national survey during 1998 under guidance from the Focus Group. This has revealed over 10,000 new records, with over 3,000 in Greater London, and the results are to be subject to further analysis, in terms of physical and topographic factors; details of which will be the subject of another paper.

Acknowledgements

The author would like to thank all those who contributed to the survey, especially those who sent in data and the newspapers that gave it coverage. I would also like to thank Dan Hackett (Lucanidae recorder for LNHS) and Richard A. Jones for their expertise and records, and at London Wildlife Trust, Mandy Rudd, Alistair Kirk and Nigel Errington for inputting the data and Emma Robertshaw for help on publicity. Thanks also to Malcolm Jennings (ACCS), Mike Prime (ex-LB Lewisham), and Freda Turtle, for additional records, and Alister Hayes and Sue Swales (LB Bromley), Aidan Cunningham (LB Croydon), Richard Howorth (ex-English Nature), Dr Valerie Keeble and Doug Napier (PTES), Storm Poorun (London Wildlife Trust), Ishpi Blatchley and Joyce Pitt (Orpington Field Club), and Andrew Craven (Kent Wildlife Trust) for their assistance in the survey, and especially Francesca Benedetti for bearing with 'stag beetle overload' during the summer of 1997.

Opinions and statements in this paper are the responsibility of the author and do not necessarily represent the position of London Wildlife Trust.

References

BOWDREY, J. 1997. The stag beetle *Lucanus cervus* L. (Coleoptera: Lucanidae) in north-east Essex. Results of the 1996 Colchester 'Search for Stag Beetles' survey. *Essex Nat.* **14**: 79–88.

BROMLEY WILDLIFE PARTNERSHIP. 1997. *Wanted very much alive; stag beetles.* Leaflet, Bromley Council.

BROMLEY WILDLIFE PARTNERSHIP. 1998. *The future of Darwin's wildlife in Bromley: the Bromley Local Biodiversity Action Plan* (draft). Bromley Council.

CLARK, J.T 1966. The distribution of *Lucanus cervus* (L.) (Col., Lucanidae) in Britain. *Entomologist's mon. Mag.* **102**: 199–204.

DONISTHORPE, H. 1941. The distribution of *Lucanus cervus* (L.) (Col., Lucanidae) in Britain. *Entomologist's mon. Mag.* **77**: 198.

FRITH, M. 1997. *Stag beetle action plan* (draft). Southwark Biodiversity Partnership. Unpublished.

FRITH, M. 1998*a*. The mighty stag? *Wild London,* summer 1998. London Wildlife Trust.

FRITH, M. 1998*b*. Stags of the North Woods. *The Wood Warbler* **20**: 6–7. Friends of the Great North Wood.

HACKETT, D. 1997. A call for stag beetle records in 1997. *Wildlife Network*, June/July 1997. London Wildlife Trust.

HALL, D.G. 1961. The stag beetle survey — first report. *Lond. Nat.* **40**: 80–82.

HALL, D.G. 1964. Distribution of the stag beetle in Britain. *Lond. Nat.* **43**: 67–72.

JENNINGS, M. 1998. *The Croydon Garden Wildlife Survey, 1997.* Association of Croydon Conservation Societies.

LEWIS, H.L. 1941. The distribution of *Lucanus cervus* (L.) (Col., Lucanidae) in Britain. *Entomologist's mon. Mag.* 77: 180.

PLANT, C.W. 1994. A map of the surface geology of the London Area. *Lond. Nat.* **73**: 215–220 and supplement.

TULLETT, A.G. 1998. *Conservation status and habitat requirements of the stag beetle,* Lucanus cervus *(L.) in Britain.* Dissertation for University of East Anglia, Norwich.

TURTLE, F. 1997. Personal communication.

UK STEERING GROUP. 1995. *UK Biodiversity Action Plan. Part 2 Action Plans.* HMSO.

Book review

Butterflies of Greater Manchester. Peter B. Hardy. PGL Enterprises. 1998. 127 pp., 16 monochrome habitat photographs, 15 colour photographs printed inside front and rear covers, 170 maps. A5. Paperback, £9 plus £1.20 UK p. & p. from PGL Enterprises, 10 Dudley Road, Sale, Cheshire M33 7BB. ISBN 0 9532374 0 0.

This book contains some rather innovative features — presented at a time when it is now rather difficult to think of something different to do in presenting a local or regional butterfly fauna. Distribution maps are presented for all butterflies recorded since 1980 in Greater Manchester using the standard 2 × 2 kilometres tetrad unit; older records are mapped to ten-kilometre square. Maps of environmental features such as urban cover, railways, roads and waterways accompany these to aid distribution. How good to see a *real* coverage map — not dots of different sizes to indicate the number of species found in each square but symbols depicting the actual number of *recording visits* made! Now, a 7 × 5 kilometre area is selected and butterfly distributions are mapped at 1-km scale, alongside grass and semi-natural vegetation potentially suitable as habitat, and urban cover, heavily grazed sites and formal open spaces as unsuitable habitats — all mapped at the 100-metre-square level. Finally, for a 3 × 2 km zone within the 7 × 5 km zone, maps for species and for their food plants are presented for 100 × 100 metre squares.

The introductory text discusses survey methods, Manchester's environments, species richness and distributions, distribution changes and conservation before embarking upon the species accounts. The day-flying burnet moths (Zygaenidae) are also afforded a brief mention — I should think this is quite useful in a book aimed at a general readership. A table records the species recorded in the 7 × 5 km zone indicating the number of 100-m squares in which each species was recorded each year from 1994 to 1997 and this is followed by a list of nectar sources for each species, as recorded during the survey.

There is much useful information in this book and it is evident that the author has done the work and got the results, rather than falling into the trap of so many authors of repeating phrases from existing texts. Thus, the larval food plants recorded are those for the Manchester area as are the nectar sources in Tables 2 and 3.

This book does not pretend to be something special. It is not a glossy hardbound tome to be admired by visitors; rather it is an honest attempt to record and analyse aspects of Manchester's butterflies. In doing this, it actually *is* something special! In the words of R.H.L. Dennis who wrote the Foreword, 'Altogether, this atlas represents an original concept and a remarkable achievement, a testimony to Peter Hardy's dedication and industry'.

Colin W. Plant

Book reviews

Deer or the new woodlands. Edited by Melvyn Jones, Andrew J. McCarthy and Ian D. Rotherham. *The Journal of Practical Ecology and Conservation,* Special Publication No. 1. 1999, expanded edition, first published 1996. 77 pp. £10. ISSN 1354 0270. Published by Wildtrack Publishing, PO Box 1142, Sheffield S1 1SZ.

This book, subtitled *Managing deer in community forests and the urban fringe,* comprises a collection of ten referenced papers which have been produced as Special Publication No. 1 in *The Journal of Practical Ecology and Conservation* following a national conference held at Sheffield Hallam University in 1996. The journal has an easy-to-read layout which presents information in a clear and concise way without compromising scientific content.

My one concern is the poor design of the distribution maps used in one of the papers. Being unfamiliar with the south Yorkshire area, I am still no wiser about the geographical layout of the major towns and surrounding woodlands as the code for wood and urban areas appears uniformly black on my copy and several of the names of towns are obliterated — though whether by buildings or trees I cannot say!

As a result of the origin of the publication, a number of the papers refer to the north-east of England or are written by authors from that region. In addition, the subject matter of the majority of the contents tends to be management related, rather than dealing with the ecology of the different species.

There are, however, two useful papers on deer in urban areas which are directly relevant to the London area, together with an interesting review of the impact of increasing numbers of muntjac *Muntiacus reevesi.* In summary, this is an attractive book which draws together a number of important national issues concerning deer, their impact on habitats and the management of their populations. The editors and individual authors are to be congratulated for their work — if the proceedings of all conferences were published, a lot more information would be disseminated to a much wider audience.

CLIVE HERBERT

The plants of Nottingham. A city flora. Peter Shepherd. Wildtrack Publishing for the Nottingham Natural History Museum and the Nottinghamshire Wildlife Trust. 1998. *The Journal of Practical Ecology and Conservation,* Special Publication No. 2. v, 68 pp. £8 + £1 p. & p. softback, ISSN 1354 0270; also numbered limited hardback edition £15 + £2 p. & p.

Though the detailed listing of the flora of over 700 species, which takes up only thirty-five pages of this booklet, may be of interest only to the people of and visitors to Nottingham, anyone interested in the natural history of cities can learn from the rest of it. How does urbanization effect the natural environment? Why do cities have a number of plant species far exceeding that of adjacent and much larger rural areas? What should be the attitude of nature conservation bodies to urban habitats, which are likely to have unstable populations of mostly alien species? All these questions have clear answers here.

R. M. BURTON

Readers are invited to write to Dr Ian D. Rotherham, Managing Editor, Wildtrack Publishing, PO Box 1142, Sheffield S1 1SZ, for details of other publications of urban and general natural history interest. Ed.

Spider records for London and Middlesex in 1998, damage to an important spider habitat, and a revised species list

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Abstract

New and interesting spider records for the London Area in 1998 are detailed, and a correction made to a find reported in *Lond. Nat.* 77. There are five new county records for Middlesex and one for London. An up-to-date list of species recorded for the two counties (London 261 spp., Middlesex 270 spp.) is given, detailing numbers of records, national conservation status and proposed London conservation status for each. For those species known from a single site in the county of London the localities (though not the precise sites) are identified. Some observations about limitations of the lists and possible changes in London's spider fauna are suggested. Damage to an important site for rare spiders on Hampstead Heath is reported, and to prevent further habitat loss the declaration of a substantial part of the Heath as a Site of Special Scientific Interest is recommended.

Introduction

This year pitfall-trapping has been scaled down on Hampstead Heath although regular monthly trapping continues at Queen's Wood, as it has since 1988. A few interesting records resulted from the trapping but no new species for either London or Middlesex counties.

However, an area which had previously been neglected in the Colne Valley (north-west Middlesex) was examined for perhaps the first time by two arachnologists and several new records produced. Another new record resulted from the continuing survey of Buckingham Palace Gardens. In total five species were recorded for the first time from Middlesex and one new species was recorded for London.

Nomenclature used is according to Merrett et al. (1985) with amendments by Merrett and Millidge (1992) and Nellist (1998).

In the list below the species marked * are new records for London and those marked ** are new records for Middlesex.

Records for 1998

THOMISIDAE

A single female *Xysticus audax*** was swept from reeds and other lakeside vegetation at Stockers Lake, near Rickmansworth which straddles the border between Middlesex and Hertfordshire. The lake is an old gravel pit in the Colne Valley fringed by reeds and other marshland vegetation and was investigated in June by Doug Marriot and David Nellist.

SALTICIDAE

A handsome jumping spider with a bright red abdomen was collected inside an office at St Mary's Hospital by Gillian Brown. As it was clearly not a British species the author passed it on to Paul Hillyard (a salticid specialist) of The Natural History Museum, who identified it as a subadult *Phidippus* C. L. Koch, 1846 species. How it reached the office at St Mary's Hospital is a mystery, but the most likely explanation is that it emerged from a box containing computer equipment which had recently been imported from the USA.

THERIDIIDAE

A single female *Theridion instabile** was collected by David Nellist in June at Buckingham Palace Gardens as part of the joint survey of the Gardens being conducted by the London Natural History Society with staff from The Natural History Museum. Several other unusual records from the Gardens have previously been reported by the writer (Milner 1998), but their significance must be regarded as provisional (see below) until further specimens have been found.

A number of specimens of *Theridion hemerobium*** were collected from lakeside vegetation at Stockers Lake and in vegetation along the banks of the Colne River by Doug Marriott and David Nellist on separate dates in June.

A single *Enoplognatha latimana* was taken by the author in a pitfall-trap in Queen's Wood: this is the first record for the species at this site and only the second record for Middlesex.

TETRAGNATHIDAE

Individuals of several *Tetragnatha* spp. were swept from lakeside vegetation at Stockers Lake by Doug Marriott and Dave Nellist in June, among them being specimens of both *T. striata*** and *T. nigrita.*

ARANEIDAE

During this year several specimens of *Araneus diadematus* were reported from central London locations. June Stubbs (of the Thorney Island Society) rescued two large females from a tiny development site near Westminster Abbey in St James's, and James Finbar Ward found another in a spectacular web on a second-floor balcony of a block of flats near Waterloo. *A. diadematus* seems to be at home in almost any garden or small open space with bushes and sunlight, throughout the capital.

LINYPHIIDAE

First a correction. In the last *London Naturalist,* Honey, Leigh and Brooks (1998) reported species found in the Wildlife Garden in the grounds of The Natural History Museum. The list of spiders found included a male linyphiid *Dicymbium nigrum* which would have been a new record for the county of London. However David Nellist has since informed me (pers. comm.) that his original identification was incorrect and that the specimen was in fact *Dicymbium brevisetosum,* a common species found in many open spaces in London especially in damp grassy areas. In fact *D. nigrum* has been recorded from Stanmore Common but not any nearer to central London than that.

Two further new linyphiid species for Middlesex were reported by Doug Marriott and David Nellist from Stockers Lake during 1998: *Theridiosoma gemmosum*** (Nationally Notable B) and *Hylyphantes graminicola***.

The only *Red data book* spider in London, *Tapinocyboides pygmaeus,* may be increasing in numbers — certainly 1998 seems to have been a very good year for it. This tiny, pale grassland specialist occurs on Hampstead Heath; during 1998 it was trapped at three widely separated sites and altogether twenty-six specimens were taken.

Discussion

It is twelve years since the publication of 'A new list of spiders in London' (Milner 1987), but as so many additional species have been recorded in the past decade it was thought appropriate to publish an updated list. The total number of species recorded for the county of London at present is 261 (42 more than were known in 1987) and for Middlesex 270.

The Appendix gives an updated list of species recorded for both London and Middlesex counties. It also includes:

A — the national conservation status as listed by JNCC.

B — for the London records, a proposed local categorization based on the number of sites from which each species is known.

S (Site) — for species known only from a single London site, the location of that site.

Among the species recorded for the two counties are two *Red data book* species (1 in London, and 1 in Middlesex), and the following Nationally Notable species: London — 7 Notable A and 3 Notable B; Middlesex — 3 Notable A and 12 Notable B. Both counties also have a number of species whose conservation status has yet to be established by JNCC. In terms of conservation, local or regional status should also be assessed.

The Appendix indicates a proposed London conservation status according to six categories based on the number of London sites from which each species has been recorded. The highest category (05), is reserved for species recorded from just a single site. In total fifty-two species come into this category — that of the rarest London spiders. The majority of these species are found in just a handful of sites: Hampstead Heath (15 spp.), Oxleas Wood (8 spp.), Putney Heath (4 spp.) and so on, with some other localities, such as Chiswick Eyot, being important because they offer unique habitats.

Some of the records for Buckingham Palace Gardens should be treated with caution: at least two species (*Zilla diodia* and *Trichopterna thorelli*) have been found there only as single males, and these may have arrived in the Gardens on the many shrubs and other garden plants which are brought in from outside London. Of course subsequent searches may confirm that these species are indeed established in the Gardens.

When interpreting the list a number of points should be borne in mind. In London there are several species that were recorded historically (those not seen since 1957 are marked * in the list) but which have not been seen in recent years. This point was made by the writer in the previous list for London (Milner 1987), and in fact several species in this category, most notably *Atypus affinis,* have subsequently been rediscovered. But others must be assumed extinct in the area — the spectacular *Araneus marmoreus* will probably never reappear unless undisturbed bushy sites can be provided and the spider possibly reintroduced. Other species that have not been seen for over forty years are less easy to categorize. *Agroeca brunnea* occurs at Coldfall Wood, a mile or two north of London, and may well still be present, but if so it has been missed on Hampstead Heath. On the other hand, *Evarcha falcata,* recorded some decades ago from several places in London, has not been seen anywhere in London or Middlesex for many years. Habitat loss still takes place of course: the one site where *Lessertia dentichelis* was found — the edge of a marsh in Greenwich — has since been drained and 'developed'.

While the list includes a number of doubtful species in terms of present-day occurrence, there are also a number of species which are clearly under recorded. Most of the commonest species are probably underestimated. Species such as *Harpactea hombergi, Clubiona corticalis* and *Tegenaria* spp. are common all over London but rarely recorded. Synanthropic species are often overlooked — especially those that are rather secretive such as *Scytodes* *thoracica* and *Oonops domesticus*. There are also many unexamined ponds in the county which probably harbour populations of *Argyroneta aquatica*.

There are some species unknown in the county of London but which have been found very close to the border of the county — two examples are *Zelotes apricorum* and *Philodromus praedatus*. Some of these species may appear in London in the future. In fact substantial changes in London's spider fauna can be expected as the climate shifts. Some spiders which have apparently only recently arrived in England from further south have yet to appear in London although they have been recorded from adjacent counties such as Kent and Essex. Three *Zodarion* species are now known in the south of England but so far only *Z. italicum* has appeared in London, and that at just one site so far, Brompton Cemetery.

If the climate changes as predicted, some more southern species may arrive, and the spectacular *Argiope bruennichi* may even extend its range northwards from the south coast as far as London. Although around the same size as *Araneus marmoreus* (mentioned above), *A. bruennichi* seems to thrive in quite disturbed places where the food and climate are appropriate. Only marginal changes to the climate could mean that this spectacular spider might survive even on Hampstead Heath, if there are to be increasing numbers of prey species such as grasshoppers. *A. bruennichi* is already known from several sites in Essex (Peter Harvey, pers. comm.).

The single record of the pan-tropical *Coleosoma blanda* at Queen's Wood remains a mystery but further records in the future must be considered a possibility. In tropical areas it occurs on disturbed ground such as roadside grass, a habitat which is in abundant supply in the London area.

Of course there may also be some losses from habitat change and human interference. The future conservation status and management of Hampstead Heath and the other important sites such as Oxleas Wood must be considered of vital significance to spider diversity in London.

Damage to an important spider habitat

A serious matter to report is the damage caused in mid October 1998 when the functioning of a special machine for mowing on steep slopes was 'demonstrated' on one of the most diverse and important grass slopes of the whole of Hampstead Heath — possibly of the whole of London. The site of this damage was above the Vale of Health where the unique colony of the tube-web spider *Atypus affinis* is found — a colony which has survived recent decades of mowing and disturbance against all the odds (Milner 1995): it had not been seen for a century until it was rediscovered in 1994. Several other rare spiders and unusual plants occur on this slope, some of them nowhere else in London. More than half the grassy part of the slope was damaged by the mowing machine.

Apparently consideration is being given by the managers of the Heath to the idea of such a machine being used in future on the sloping parts of the Heath. This would clearly be a mistake: the writer is firmly of the opinion that had such equipment been used during the past years the tube-web spider colony, and possibly several other species would not have survived at all. One wonders if they will survive the next ten years, never mind the next century, unless proper management is drawn up and then conscientiously implemented. The possibility that a substantial part of the Heath be declared a Site of Special Scientific Interest should now be considered as a matter of urgency.

References

HONEY, M.R., LEIGH, C. and BROOKS, S.J. 1998. The fauna and flora of the newly created Wildlife Garden in the grounds of The Natural History Museum, London. *Lond. Nat.* **77**: 17–47.

MERRETT, P., LOCKET, G.H. and MILLIDGE, A.F. 1985. A check list of British spiders. *Bull. Br. arachnol. Soc.* **6**: 381–403.

MERRETT, P. and MILLIDGE, A.F. 1992. Amendments to the check list of British spiders. *Bull. Br. arachnol. Soc.* **9**: 4–9.

MILNER, J.E. 1987. A new list of spiders found in London. *Lond. Nat.* **66**: 101–110.
MILNER, J.E. 1995. The tube-web spider *Atypus affinis* rediscovered on Hampstead Heath after more than a century. *Lond. Nat.* **74**: 127–138.
MILNER, J.E. 1998. Spider records for the London Area in 1997. *Lond. Nat.* **77**: 147–148.
NELLIST, D.R. 1998. SRS working list. *Newsl. Spider Recording Scheme, Br. arachnol. Soc.* **31**: 1–3.

APPENDIX

Revised species list for London and Middlesex including national conservation status (as designated by JNCC), and proposed London conservation status.

Key

* = not recorded in London county since 1957; ** = not recorded since 1963; # = not recorded since 1972; ++ = recorded in 1987, but habitat has since been destroyed by industrial development.

A = national conservation status as designated by the JNCC (Joint Nature Conservation Committee): Comm = common; Loc = local; S/an = synanthropic; *RDB*-3 = *Red data book* category 3; Nat = naturalized; Na = Nationally Notable A; Nb = Nationally Notable B; ? = status undefined.

B = Proposed London conservation status:
00 = 20+ London sites: no conservation value (23 spp.)
01 = 15–19 London sites: little conservation value (20 spp.)
02 = 10–14 London sites: of some local value (34 spp.)
03 = 5–9 London sites: important local species (63 spp.)
04 = 2–4 London sites: locally rare or threatened species (67 spp.)
05 = 1 London site only: of the highest local conservation status (53 spp. of which nine have not been recorded in London since 1957).

L = London records
M = Middlesex records
S = For London records, only known location.

A	B	Species	L	M	L+M	S
ATYPIDAE						
Loc	05	*Atypus affinis*	1	—	1	Hampstead Heath
AMAUROBIIDAE						
Comm	04	*Amaurobius fenestralis*	2	1	3	
Comm	02	*Amaurobius similis*	12	6	18	
Comm	03	*Amaurobius ferox*	7	9	16	
DICTYNIDAE						
Comm	04	*Dictyna arundinacea*	3	10	13	
Comm	02	*Dictyna uncinata*	14	26	40	
Loc		*Dictyna latens*	—	2	2	
Na	04	*Nigma walckenaeri*	4	5	9	
Loc	05	*Lathys humilis*	1	2	3	Hampstead Heath
OONOPIDAE						
Comm	04	*Oonops pulcher*	2	1	3	
S/an	03	*Oonops domesticus*	7	3	10	
DYSDERIDAE						
Comm	03	*Dysdera crocata*	7	4	11	
Comm		*Dysdera erythrina*	—	2	2	
Comm	03	*Harpactea hombergi*	9	8	17	
SEGESTRIIDAE						
Comm	04	*Segestria senoculata*	3	5	8	
S/an	04	*Segestria florentina*	3	1	4	

A	B	Species	L	M	L+M	S
SCYTODIDAE						
S/an	05	**Scytodes thoracica*	1	4	5	Catford
PHOLCIDAE						
S/an	04	*Pholcus phalangioides*	2	1	3	
S/an	04	*Psilochorus simoni*	3	—	3	
ZODARIIDAE						
Nat	05	*Zodarion italicum*	1	2	3	Brompton Cemetery
GNAPHOSIDAE						
Comm	02	*Drassodes lapidosus*	11	14	25	
Loc	05	**Drassodes cupreus*	1	4	5	Catford
Loc		*Drassodes pubescens*	—	—	1	Gunnersbury Triangle
Loc		*Drassyllus pusillus*	—	1	1	Bentley Priory
Loc		*Zelotes apricorum*	—	—	3	
Loc	05	**Haplodrassus signifer*	1	1	2	Greenwich Park
S/an	03	*Scotophaeus blackwalli*	9	7	16	
Loc	03	*Zelotes latreillei*	5	9	14	
S/an	05	*Urozelotes rusticus*	1	—	1	Holborn Underground Station
Comm	02	*Micaria pulicaria*	13	9	22	
CLUBIONIDAE						
Comm	00	*Clubiona corticalis*	21	18	39	
Comm	02	*Clubiona reclusa*	11	15	26	
Comm	05	*Clubiona stagnatilis*	1	5	6	Hampstead Heath
Comm	05	*Clubiona pallidula*	1	—	1	Buckingham Palace Gardens
Loc	03	*Clubiona phragmitis*	7	9	16	
Comm	00	*Clubiona terrestris*	29	28	57	
Loc	04	*Clubiona neglecta*	4	3	7	
Comm	03	*Clubiona lutescens*	7	14	21	
Comm	03	*Clubiona compta*	9	11	20	
Comm	03	*Clubiona brevipes*	6	8	14	
Comm	04	*Clubiona trivialis*	3	9	12	
Loc		*Clubiona subtilis*	—	2	2	
Loc	04	*Clubiona diversa*	3	9	12	
Comm	04	*Cheiracanthium erraticum*	2	5	7	
LIOCRANIDAE						
Comm	02	*Phrurolithus festivus*	10	16	26	
Loc	05	**Agroeca brunnea*	1	1	2	Hampstead Heath
Comm	04	*Agroeca proxima*	2	—	2	
Loc	04	*Agroeca inopina*	2	1	3	
ZORIDAE						
Comm	03	*Zora spinimana*	9	15	24	
ANYPHAENIDAE						
Comm	04	*Anyphaena accentuata*	2	2	4	
HETEROPODIDAE						
Loc	04	*Micrommata virescens*	2	—	2	
THOMISIDAE						
Loc	04	**Diaea dorsata*	2	1	3	
Comm	00	*Xysticus cristatus*	29	24	53	
Loc	04	*Xysticus kochi*	3	3	6	
Loc	04	*Xysticus erraticus*	3	2	5	
Loc		*Xysticus ulmi*	—	1	1	Pond Wood

A	B	Species	L	M	L+M	S
Comm		*Xysticus audax*	—	1	1	Stockers Lake
Comm	05	*Xysticus lanio*	1	1	2	Oxleas Wood
Loc	04	*Ozyptila sanctuaria*	2	—	2	
Comm	04	*Ozyptila praticola*	3	7	10	
Loc		*Ozyptila simplex*	—	1	1	The Paddock, Tottenham
PHILODROMIDAE						
Comm	02	*Philodromus dispar*	14	18	32	
Comm	02	*Philodromus aureolus*	10	7	17	
Comm	04	*Philodromus cespitum*	3	13	16	
Nb		*Philodromus albidus*	—	1	1	Hounslow Heath (LNR)
Nb		*Philodromus praedatus*	—	3	3	
Comm	03	*Tibellus oblongus*	9	13	22	
Loc		*Tibellus maritimus*	—	—	6	
SALTICIDAE						
Comm	02	*Salticus scenicus*	11	6	17	
Na	04	*Salticus zebraneus*	2	2	2	
Nb		*Marpissa muscosa*	—	4	4	
Comm	05	*Heliophanus cupreus*	1	—	1	Bostall Heath
Comm	05	*Heliophanus flavipes*	1	2	3	Hampstead Heath
Comm	05	*Ballus chalybeius*	1	1	2	Oxleas Wood
Loc	05	*Neon robustus*	1	3	4	Dulwich Wood
Comm	01	*Euophrys frontalis*	18	17	35	
Loc	04	*Euophrys aequipes*	4	—	4	
Loc	04	*Euophrys lanigera*	4	2	6	
Loc	03	*Sitticus pubescens*	6	3	9	
Comm	04	**Evarcha falcata*	2	—	2	
LYCOSIDAE						
Comm	05	**Pardosa monticola*	1	—	1	Charlton
Comm	02	*Pardosa palustris*	13	10	23	
Comm	00	*Pardosa pullata*	25	27	52	
Comm	02	*Pardosa prativaga*	13	16	29	
Comm	02	*Pardosa amentata*	10	18	28	
Comm	05	*Pardosa nigriceps*	1	4	5	Hampstead Heath
Comm	02	*Pardosa silvicultrix*	10	11	21	
Comm	01	*Alopecosa pulverulenta*	16	20	36	
Loc	04	*Alopecosa cuneata*	4	—	4	
Comm	03	*Trochosa ruricola*	8	9	17	
Comm	02	*Trochosa terricola*	12	21	33	
Loc	02	*Pirata piraticus*	10	13	23	
Comm	05	*Pirata hygrophilus*	1	2	3	Hampstead Heath
Loc	05	*Pirata uliginosus*	1	4	5	Hampstead Heath
Loc	04	*Pirata latitans*	2	—	2	
PISAURIDAE						
Comm	00	*Pisaura mirabilis*	21	26	47	
ARGYRONETIDAE						
Loc	05	**Argyroneta aquatica*	1	1	2	Putney Heath
AGELENIDAE						
Comm	04	*Agelena labyrinthica*	4	4	8	
Loc	01	*Tegenaria gigantea*	16	14	30	
S/an	03	*Tegenaria atrica*	8	3	11	
S/an	03	**Tegenaria parietina*	6	1	7	
Loc	03	*Tegenaria agrestis*	5	9	14	

A	B	Species	L	M	L+M	S
Comm	03	*Tegenaria domestica*	6	6	12	
Loc	03	*Tegenaria silvestris*	6	3	9	
Comm	05	*Coelotes atropos*	1	—	1	Hampstead Heath
Nb	03	*Coelotes terrestris*	7	2	9	
Loc	04	*Cicurina cicur*	2	5	7	
HAHNIIDAE						
Loc	04	*Antistea elegans*	4	10	14	
Comm	04	*Hahnia montana*	4	1	5	
Loc	03	*Hahnia nava*	6	11	17	
Loc	05	*Hahnia helveola*	1	2	3	Oxleas Wood
MIMETIDAE						
Comm	04	*Ero cambridgei*	4	7	11	
Comm	02	*Ero furcata*	13	13	26	
THERIDIIDAE						
Loc	04	*Episinus angulatus*	3	1	4	
Comm	03	*Steatoda bipunctata*	8	9	17	
Loc	05	**Steatoda grossa*	1	—	1	Docklands
Loc		*Crustulina guttata*	—	2	2	
Comm	03	*Anelosimus vittatus*	8	12	20	
Loc	04	*Achaearanea lunata*	2	4	6	
S/an	05	**Achaearanea tepidariorum*	1	1	2	Buckingham Palace Gardens
Comm	03	*Theridion sisyphium*	5	14	19	
Loc	04	*Theridon pictum*	2	2	4	
Comm	03	*Theridion varians*	6	10	16	
S/an	03	*Theridion melanurum*	5	3	8	
Comm	04	*Theridion mystaceum*	3	5	8	
Loc	02	*Theridion tinctum*	11	7	18	
Loc		*Theridion impressum*	—	2	2	
Comm		*Theridion simile*	—	1	1	Totteridge Fields
Nb		*Theridion familiare*	—	1	1	West Heath, Hampstead
?		*Theridion hemerobium*	—	2	2	
Loc		*Theridion instabile*	1	2	3	Buckingham Palace Gardens
Comm	02	*Theridion bimaculatum*	10	22	32	
Comm	02	*Theridion pallens*	11	11	22	
Comm	02	*Enoplognatha ovata*	14	29	43	
Loc	04	*Enoplognatha latimana*	3	2	5	
RDB-3		*Enoplognatha oelandica*	—	1	1	Alexandra Park
Loc	02	*Enoplognatha thoracica*	11	7	18	
Comm	02	*Robertus lividus*	11	9	20	
Loc		*Robertus arundineti*	—	1	1	Hounslow Heath LNR
Loc		*Theonoe minutissima*	—	1	1	Harrow
Comm	03	*Pholcomma gibbum*	9	8	17	
?		*Coleosoma blanda*	—	—	1	Queen's Wood
NESTICIDAE						
Loc	03	*Nesticus cellulanus*	5	4	9	
TETRAGNATHIDAE						
Comm	03	*Tetragnatha extensa*	7	11	18	
Loc	03	*Tetragnatha montana*	5	8	13	
Comm	04	*Tetragnatha obtusa*	2	1	3	
Nb		*Tetragnatha pinicola*	—	4	4	
Loc		*Tetragnatha nigrita*	—	3	3	
Nb		*Tetragnatha striata*	—	1	1	Stockers Lake
Comm	01	*Pachygnatha clercki*	16	20	36	

A	B	Species	L	M	L+M	S
Comm	00	*Pachygnatha degeeri*	28	31	59	
Comm	02	*Metellina segmentata*	12	18	30	
Comm	03	*Metellina mengei*	8	16	24	
Loc	04	*Metellina merianae*	2	3	5	
Comm	02	*Zygiella x-notata*	12	13	25	
Comm	04	*Zygiella atrica*	3	6	9	
ARANEIDAE						
Comm	04	*Gibbaranea gibbosa*	3	5	8	
Comm	00	*Araneus diadematus*	23	15	38	
Comm	04	*Araneus quadratus*	3	5	8	
Loc	04	**Araneus marmoreus*	2	—	2	
Comm	05	*Larinioides cornutus*	1	5	6	Gillespie Park
Loc	04	*Larinioides sclopetarius*	3	4	7	
Comm	03	*Nuctenea umbratica*	9	10	19	
Loc		*Agelenatea redii*	—	3	3	
Loc		*Neoscona adianta*	—	2	2	
Loc		*Araneus triguttata*	—	2	2	
Loc	05	*Araneus sturmi*	1	1	2	Regent's Park Canal
Comm	02	*Araniella cucurbitina*	12	23	35	
Loc	03	*Araniella opisthographa*	5	2	7	
Nb		*Araniella inconspicua*	—	1	1	Ruislip Common
Comm		*Mangora acalypha*	—	2	2	
Nb	05	*Zilla diodia*	1	1	2	Buckingham Palace Gardens
Loc	04	*Hypsosinga pygmaea*	2	3	5	
Loc	05	*Cyclosa conica*	1	6	7	Wandsworth Common
THERIDIOSOMATIDAE						
Nb		*Theridiosoma gemmosum*	—	1	1	Stockers Lake
LINYPHIIDAE						
Comm	05	#*Ceratinella brevipes*	1	4	5	Hampstead Heath
Comm	00	*Walckenaeria acuminata*	20	17	37	
Comm	01	*Walckenaeria antica*	19	18	37	
Comm	03	*Walckenaeria cucullata*	7	10	17	
Loc	03	*Walckenaeria atrotibialis*	9	5	14	
Loc	05	*Walckenaeria dysderoides*	1	—	1	Oxleas Wood
Comm	03	*Walckenaeria nudipalpis*	6	7	13	
Na	05	*Walckenaeria corniculans*	1	—	1	Dulwich Wood
Loc	04	*Walckenaeria furcillata*	2	—	2	
Comm	03	*Walckenaeria unicornis*	5	15	20	
Comm	04	*Walckenaeria cuspidata*	2	1	3	
Loc		*Walckenaeria monoceros*	—	2	2	
Loc		*Dicymbium nigrum*	—	2	2	
Loc	01	*Dicymbium brevisetosum*	16	16	32	
Comm		*Entelecara acuminata*	—	5	5	
Nb	05	*Entelecara congenera*	1	—	1	Hampstead Heath
Loc	03	*Entelecara erythropus*	5	3	8	
Loc	05	*Entelecara flavipes*	1	—	1	Putney Heath
Comm	05	*Moebelia penicillata*	1	3	4	Bostall Heath
Loc		*Hylyphantes graminicola*	—	1	1	Stockers Lake
Comm	02	*Gnathonarium dentatum*	11	19	30	
Comm	01	*Gongylidium rufipes*	17	21	38	
Loc	03	*Dismodicus bifrons*	6	10	16	
Comm	03	*Hypomma bituberculatum*	6	5	11	
Comm	05	*Hypomma cornutum*	1	4	5	Putney Heath
Loc		*Metopobactrus prominulus*	—	1	1	The Willows, Tottenham

A	**B**	**Species**	**L**	**M**	**L+M**	**S**
Comm	04	*Gonatium rubens*	2	2	4	
Comm		*Gonatium rubellum*	—	2	2	
Comm	01	*Maso sundevalli*	18	25	43	
Comm	04	*Pocadicnemis pumila* (s.s.)	2	3	5	
Comm	02	*Pocadicnemis juncea*	14	21	35	
Comm	03	*Oedothorax gibbosus*	8	10	18	
Comm	00	*Oedothorax fuscus*	21	21	42	
Loc	04	*Oedothorax agrestis*	3	2	5	
Comm	01	*Oedothorax retusus*	16	17	33	
Loc	04	*Oedothorax apicatus*	2	—	2	
Loc	05	*Trichopterna thorelli*	1	—	1	Buckingham Palace Gardens
Loc	04	*Pelecopsis parallela*	4	4	8	
Loc	05	*Silometopus elegans*	1	1	2	Putney Heath
Loc	03	*Cnephalocotes obscurus*	5	8	13	
Loc	04	*Ceratinopsis stativa*	3	2	5	
Comm	00	*Tiso vagans*	21	13	34	
Loc	03	*Troxochrus scabriculus*	5	2	7	
Loc	03	*Tapinocyba praecox*	6	4	10	
Loc	05	*Tapinocyba insecta*	2	—	2	
RDB-3	04	*Tapinocyboides pygmaeus*	2	—	2	
Loc		*Microctenonyx subitaneus*	—	1	1	The Willows, Tottenham
Loc	05	***Thyreosthenius parasiticus*	1	—	1	Buckingham Palace Gardens
Comm	01	*Monocephalus fuscipes*	17	16	33	
Loc	04	*Lophomma punctatum*	4	8	12	
Comm	01	*Gongylidiellum vivum*	15	21	36	
Comm	01	*Micrargus herbigradus*	19	23	42	
Loc		*Micrargus apertus*	—	1	1	Alexandra Park
Loc	03	*Micrargus subaequalis*	9	11	20	
Comm	03	*Erigonella hiemalis*	6	7	13	
Comm	02	*Savignia frontata*	12	8	20	
Comm	01	*Diplocephalus cristatus*	16	8	24	
Comm	03	*Diplocephalus permixtus*	8	14	22	
Comm	01	*Diplocephalus latifrons*	19	15	34	
Comm	00	*Diplocephalus picinus*	25	25	50	
Comm	04	*Araeoncus humilis*	4	1	5	
Loc	02	*Panamomops sulcifrons*	11	5	16	
Loc	05	++*Lessertia dentichelis*	1	1	2	Greenwich
Loc	01	*Milleriana inerrans*	18	9	27	
Comm	00	*Erigone dentipalpis*	34	19	53	
Comm	00	*Erigone atra*	35	26	61	
Loc		*Erigone promiscua*	—	1	1	Staines Moor
Loc	05	**Erigone arctica*	1	—	1	Woolwich
Loc	05	*Erigone longipalpis*	1	—	1	Chiswick Eyot
Loc	04	*Prinerigone vagans*	3	2	5	
Comm	03	*Leptorhoptrum robustum*	6	4	10	
Na	05	*Wiehlea calcarifera*	1	—	1	Oxleas Wood
Nat	04	*Ostearius melanopygius*	4	1	5	
Comm	05	*Porrhomma pygmaeum*	1	8	9	Oxleas Wood
Loc	04	*Porrhomma campbelli*	3	—	3	
Loc	03	*Porrhomma microphthalmum*	5	5	10	
Nb	05	*Porrhomma errans*	1	—	1	Buckingham Palace Gardens
Nb		*Porrhomma oblitum*	—	1	1	Pond Wood
?		*Porrhomma cambridgei*	—	1	1	Coldfall Wood
Comm	05	*Agyneta conigera*	1	1	2	Hampstead Heath
Loc	04	*Agyneta decora*	4	3	7	

A	B	Species	L	M	L+M	S
Comm	00	*Meioneta rurestris*	24	17	41	
Loc	05	*Meioneta mollis*	1	1	2	Hampstead Heath
Comm	02	*Meioneta saxatilis*	10	17	27	
Loc	03	*Meioneta beata*	5	7	12	
Comm	00	*Microneta viaria*	28	27	55	
Comm		*Meioneta innotabilis*	—	1	1	Queen's Wood
Comm	03	*Centromerus sylvaticus*	9	11	20	
Comm	02	*Centromerus dilutus*	12	15	27	
Nb	05	*Centromerus incilium*	1	2	3	Brompton Cemetery
Comm	03	*Tallusia experta*	5	2	7	
Comm	01	*Centromerita bicolor*	18	20	38	
Comm	03	*Centromerita concinna*	9	9	18	
Loc	05	*Sintula cornigera*	1	—	1	Oxleas Wood
Comm	03	*Saaristoa abnormis*	8	6	14	
Loc		*Saaristoa firma*	—	1	1	Coldfall Wood
Comm	01	*Macrargus rufus*	15	12	27	
Loc	04	*Bathyphantes approximatus*	3	12	15	
Comm	00	*Bathyphantes gracilis*	35	37	72	
Comm	03	*Bathyphantes parvulus*	9	13	22	
Comm	05	*Bathyphantes nigrinus*	1	1	2	Hampstead Heath
Comm		*Kaestneria dorsalis*	—	1	1	Queen's Wood
Comm	04	*Kaestneria pullata*	2	3	5	
Comm	00	*Diplostyla concolor*	29	39	68	
Loc	04	*Poeciloneta variegata*	2	—	2	
Comm		*Drapetisca socialis*	—	3	3	
Comm	02	*Tapinopa longidens*	10	6	16	
Loc	04	*Floronia bucculenta*	2	2	4	
Loc	05	*Taranucnus setosus*	1	—	1	Hampstead Heath
Comm	03	*Labulla thoracica*	7	4	11	
Comm	00	*Stemonyphantes lineatus*	21	21	42	
Comm	03	*Lepthyphantes nebulosus*	6	4	10	
Comm	03	*Lepthyphantes leprosus*	8	4	12	
Comm	01	*Lepthyphantes minutus*	18	14	32	
Comm	05	*Lepthyphantes alacris*	1	4	5	Kenwood
Loc	04	*Lepthyphantes obscurus*	3	1	4	
Comm	00	*Lepthyphantes tenuis*	43	38	81	
Comm	00	*Lepthyphantes zimmermanni*	30	27	57	
Loc	04	*Lepthyphantes cristatus*	2	—	2	
Comm	02	*Lepthyphantes mengei*	13	13	26	
Comm	00	*Lepthyphantes flavipes*	30	26	56	
Loc	05	*Lepthyphantes tenebricola*	1	—	1	Oxleas Wood
Comm	00	*Lepthyphantes ericaeus*	21	25	46	
Loc	01	*Lepthyphantes pallidus*	16	11	27	
Nb	03	*Lepthyphantes insignis*	5	—	5	
Comm	03	*Helophora insignis*	7	6	13	
Comm	01	*Linyphia triangularis*	19	23	42	
Comm	02	*Linyphia hortensis*	13	13	26	
Comm	03	*Linyphia montana*	6	9	15	
Comm	00	*Linyphia clathrata*	27	33	60	
Comm	03	*Linyphia peltata*	7	18	25	
Comm	03	*Microlinyphia pusilla*	5	4	9	
Loc		*Microlinyphia impigra*	—	—	3	

Book review

Hoverflies of Surrey. Roger K. A. Morris. Surrey Wildlife Trust. 1998. 244pp., 16 colour plates, numerous distribution maps and other text drawings. Hardback, £15 plus £2.70 p.&p. from Marketing Department, Surrey Wildlife Trust, School Lane, Pirbright, Woking, Surrey GU24 0JN, payable to Surrey Wildlife Trust. ISBN 0 9526065 3 4.

The popularity of hoverflies amongst amateur naturalists was increased greatly in 1983 with the publication by the British Entomological and Natural History Society of Alan Stubbs' magnificent identification guide *British hoverflies.* Helped, no doubt by the excellent artwork of Steven Falk, this book has sold exceptionally well and serves as a measure of the interest in hoverflies amongst the entomological community. It was, therefore, inevitable that, in the fullness of time, the new-found ease with which most hoverflies could now be named would lead to publication of county lists. Several such lists have indeed started to appear, but Surrey (which harbours a staggering 79 per cent of the British hoverfly fauna with 214 species listed) has gone one better and produced a hardbound book in which not only are distribution maps presented by tetrad, but the data gathered are interpreted and explained in great, yet understandable, detail.

Fascinating and useful though distribution maps are, I think that the main interest in this book lies with the introductory chapters. A chapter on habitat associations considers the chalk areas, heathlands, wetlands and woodlands, all of which might be expected as a standard inclusion, but Roger Morris uses the data he has collated to propose lists of hoverflies which he regards of value as indicators for each of these habitats in Surrey. His suppositions are supported by the inclusion of coincidence maps of these indicator species; a useful idea, but the lay-reader may consider it is a pity that there does not appear to be an explanation of what these maps are saying.

Some of the more important hoverfly sites in Surrey are then mentioned briefly before progressing to discussion on the recording project and the records themselves. The coverage map indicates the 512 tetrads (out of 540 possible) of the county for which hoverfly records are now available — most of those for which there are no records are marginal tetrads for which the greater part lies in an adjacent county in any case. The map indicating number of species recorded per tetrad clearly indicates that there is more recording to be done in some areas but, nevertheless, I think that the maps are ready for public viewing. As an author of a set of maps myself I am acutely aware of the great dilemma that must have faced Roger — publish now whilst the maps are current or wait until more records are available but run the risk of some of them by then being out of date. In my view, invertebrate distribution maps can never be completed in a time-frame short enough to reflect fully the real situation and provided they show a general pattern for each species which is unlikely to be altered significantly by additional survey, then I think they are ready for publication. It is clear, by way of example, that *Cheilosia pagana* is likely to be in most if not all tetrads in Surrey, in spite of there being many gaps on the map (on page 120); it is equally clear that *Volucella zonaria* (page 177) will not and that records outside north-east Surrey are not expected within the current time-frame.

Several other small but useful text sections cover data collection, storage and retrieval, recording techniques, biological observations, comparison with other recording schemes, hoverfly conservation and hoverflies and biodiversity before progressing to the species accounts. For each species, a distribution map is accompanied by concise, easy-to-digest text covering national status, Surrey status, number of records, flight times (which often involves the use of histograms) and conservation. For rarer species all the records are listed on the grounds that this will provide a sound basis for detailed study by other parties at a later date.

Appendices, following the species accounts, provide a complete checklist of Surrey species (198 currently plus eleven not seen since before 1980 and a further five unconfirmed or doubtful) and a list of flower species visited by hoverflies in Surrey. There is also a species list for Great Bookham Common, which will doubtless be of interest to those LNHS members active in our own survey of that area.

This book, by an author who is widely acknowledged and respected as one of Britain's leading authorities on hoverflies is, in keeping with others in the series, a model for future county faunas and will be of interest to both the serious entomologist and the enthusiastic beginner alike. Even though this review will not appear until December 1999, the book is included in my short-list of recommended stocking-fillers for the naturalist at Christmas.

COLIN W. PLANT

A review of the butterflies and moths (Lepidoptera) of the London Area for 1997 and 1998

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Abstract

Lepidoptera records received for the years 1997 and 1998 for the London Natural History Society's recording area are reviewed and selected species are mentioned and discussed. A number of earlier records received recently are also included in the discussion. One species, pauper pug *Eupithecia egenaria*, is recorded in the area for the first time in history bringing the all-time total of larger moth species recorded to 718. The total number of microlepidoptera listed for Middlesex (vice-county 21) now stands at 761. The small ranunculus *Hecatera dysodea*, last recorded in Britain in 1939 and last noted in the London Area in 1909, has been recorded again and is established as a locally abundant breeding species in the London portion of West Kent (vice-county 16). Several species regarded as being very locally distributed and uncommon in the London Area in the 1993 publication *Larger moths of the London Area* have apparently undergone an expansion in both numbers and geographical range. These species include red-green carpet *Chloroclysta siterata*, large ranunculus *Polymixis flavicincta*, waved black *Parascotia fuliginaria* and black arches *Lymantria monacha*, for which revised distribution maps are now presented. The dotted chestnut *Conistra rubiginea* is formally moved from Status Category 7(A) to Category 10. The mottled rustic *Caradrina morpheus* is reported on very few submitted lists and may perhaps be commencing a decline.

Introduction

My last review of the Lepidoptera of the London Area covered the years 1995 and 1996 (Plant 1997) and was the third to appear since publication of the book *Larger moths of the London Area* (Plant 1993) — a work hereinafter abbreviated to *LMLA* for reason of brevity. The present review covers records received for the years 1997 and 1998 together with a few from earlier years which were received late. As usual, those records included here represent only a few of the more interesting ones, selected from the many lists submitted to me in my capacity as recorder. Observers are credited in the text against their records, but it is important to note that many other people have also supplied data; the fact that their records were not selected by me for inclusion in this review does not in any way suggest that their contributions are of lesser value.

It has been particularly pleasing during the two years under review to continue with, and develop, the close co-operation which exists between county recorders for adjoining county areas. Records are fully exchanged between ourselves and the recorders for Kent, Surrey, Buckinghamshire and Essex (I am myself the recorder for Hertfordshire) and also with the Herts. and Middlesex Branch of Butterfly Conservation. This latter organization has been a particularly valuable source of moth records and I must record my thanks to the untiring efforts of Rob Souter in collating incoming records and then presenting them to me in the form of neatly ordered lists — something which saves me an awful lot of time. A complete list of county Lepidoptera recorders can be found in Waring (1999).

During the two years reviewed here significant advances have been made in taxonomic research within the Lepidoptera. The production in late 1996 of a new checklist of European species (Karsholt and Razowski 1996) — the first Europe-wide list since 1901 — made a great many changes both to species names and positions of these species within families. Not all of these changes have met with universal acceptance; some of the resistance can doubtless be put down to traditionalism, but whilst some changes are still hotly debated others are quite clearly valid. Thus, several of the changes have now been accepted into the British literature and a new *Checklist of Lepidoptera recorded from the British Isles* has been produced (Bradley 1998). With two minor exceptions, in that the name *Hecatera* is retained for *H. dysodea* for the reasons given in Agassiz and Spice (1998) and that *fraxinata* is retained as the specific epithet for what we know here as the ash pug until its precise relationship to *Eupithecia innotata* is sorted out, this new checklist has been adopted in the present review.

Highlights of the period under review

There can be no doubt that the most significant event of the two years under review was the rediscovery in Britain of the small ranunculus *Hecatera dysodea*, in the area around Stone Marshes, West Kent, by David Agassiz. The moth was a resident in Britain during the last century, but for reasons that are not fully clear, died out early in the present century, occasional specimens being reported up to 1939 before finally becoming extinct as a British species. In the London Area it was last reported in 1909 at Dartford. A fresh female was taken in David's trap on 26 June 1997 (his garden is just outside the LNHS boundary by one tetrad) and a very worn male was taken on 6 August. A further specimen was taken at Charlton on 14 July by William Spice. The spread of dates seemed to suggest that the species was resident rather than immigrant. On 15 July 1998, Mark Parsons, Geoff Martin and Ruud Schilder visited a quarry at Swanscombe and discovered about twenty larvae on great lettuce *Lactuca virosa* and several eggs on flowerheads of prickly lettuce *Lactuca serriola*. The rest, as they say, is history. Although it is abundant where it is present, the moth appears to be confined to a fairly small area on the southern side of the River Thames between Erith and Gravesend, stretching inland only a few kilometres along the Darent Valley. The British distribution in 1998 thus affected the five ten-kilometre squares TQ47, 56, 57, 66 and 67. In spite of diligent searching by David Agassiz, Peter Harvey, myself, and doubtless several others, the moth was apparently quite absent from the Essex side of the Thames during 1998 in spite of the short distance across the water. As a resident London species, it now qualifies for a distribution map and this is presented as Figure 1. Notwithstanding its superabundance as larvae during 1998, because of its restricted distribution it is now formally assigned to London Status Category 4 (extremely local residents — see *LMLA*, page xvii). A fuller discussion of the events surrounding the discovery and the possible origins of the moth (as well as a justification for retaining the generic name *Hecatera*) is given in Agassiz and Spice (1998).

Equally interesting as far as the London Area is concerned was the discovery of pauper pug *Eupithecia egenaria*, found in the Dorking area, within the LNHS recording zone. Larvae were located and so the species is confirmed as a resident in the area, but the precise locality is currently withheld by the observer. The species is quite new to both London and to Surrey as a whole and as far as our own area is concerned should be placed in London Status Category 4.

Also new to Surrey is the crescent striped *Apamea oblonga*, though there are London Area records, presumed to relate to vagrant examples, for West Kent up to 1955, for Middlesex up to 1962 and for South Essex as recently as 1982. To

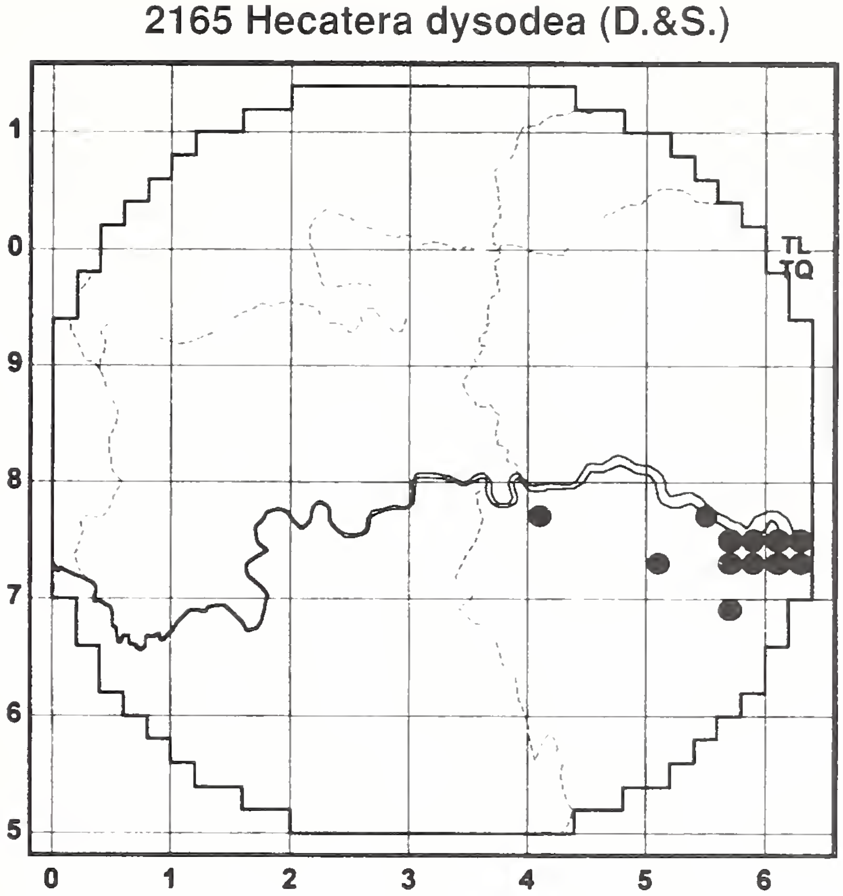

FIGURE 1. Distribution of the small ranunculus *Hecatera dysodea* in the London Area.

these may now be added one example at Barn Elms on 7 August 1997, captured by Geoff Martin. Also in Surrey, Mark Parsons captured an example of the triangle *Heterogena asella* at Raynes Park on 7 August 1998. There are only two previous records of this moth for the entire London Area — Epping Forest, Essex, last recorded in 1877 and 'local near Croydon' prior to 1898 (Buckell and Prout 1898). In *LMLA* I declared that this moth was 'now certainly extinct' in the London Area; I am delighted to be proved wrong (though am bound to point out that it has taken exactly 100 years!). The exact status of the moth still requires clarification, of course; it is possible that there is an undiscovered population in that part of the London Area, but it is equally possible that the example caught could have been a casual vagrant from further afield.

Spreading species

The distribution maps in *LMLA* included all records received for the period 1980 to 1991. Inevitably, there were many under-recorded areas, but at the time I felt relatively confident that the overall *patterns* of distribution presented were more or less a reflection of reality — new tetrad records were to be expected, but these would likely consolidate the existing pattern of map dots rather than changing it. Subsequent field work by myself and many other people did indeed fail to alter these patterns to any significant degree in the next three or four years. Thus, whilst the surprise capture of a species in an area away from its main centre of distribution may always be expected, the sudden capture of a species from several localities across a wide area of apparent earlier absence is strongly indicative of a range expansion by the species concerned. The red-green carpet *Chloroclysta siterata* was discussed in this context in the review of 1995 and 1996. Only nine records were listed in *LMLA* of which only two, both made in Surrey during 1990, were in the 1980 – 1991 'recent' period. However, since John Hollingdale's October 1996 record at Harrow, the first for Middlesex since 1898, this species has spread very rapidly and had quite literally occupied the entire London Area by the end of 1998. It is now evidently established as a resident here and publication of a revised distribution map is justified. This is presented here as Figure 2.

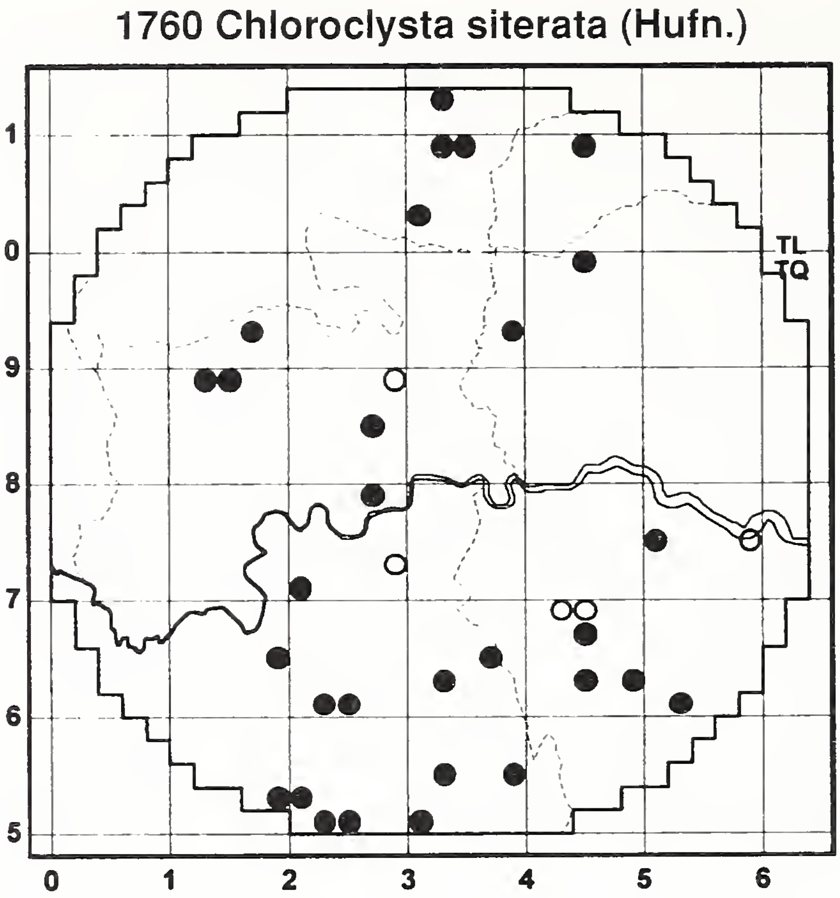
1760 Chloroclysta siterata (Hufn.)

FIGURE 2. Distribution of the red-green carpet *Chloroclysta siterata* in the London Area.

Interestingly, however, the red-green carpet is not the only moth that appears to be staging a takeover in parts of London from which it was previously absent. The spread of the large ranunculus *Polymixis flavicincta* into Middlesex from the south is evidenced by several recent records which are given in the vice-county section below. There can be no doubt that this species is now expanding its range to fill the gaps on the map; it is now present in numbers throughout Middlesex and its apparent scarcity in Essex is surely a consequence of under-recording. The current spread of this species is shown in Figure 3.

Joining the small ranunculus and the large ranunculus, the feathered ranunculus *Polymixis lichenea* is another moth which may be extending its range to establish itself as a London Area resident, though the names are pure coincidence and none is in any way related to *Ranunculus* plants. In this instance the expansion appears to be progressing westwards from the Kent coast where the moth is not uncommon. Brian West took a fresh specimen at his garden light in Dartford on 26 September 1997 to be followed by another the next night and a third the night after, all being males. Further examples were taken in other county areas during 1997, including a male in Middlesex on 8 September and a male in my garden in Bishop's Stortford, Hertfordshire, slightly outside the LNHS Area, on 19 September. The next year, James Halsey took an example in East Sheen, close to Richmond Park, on 17 September, and ten days later on 29 September, Graham Collins took another at his garden trap in South Croydon. As yet there is no evidence of the moth breeding in our area, so a distribution map is not properly justified, but it may only be a matter of time before it is.

The waved black *Parascotia fuliginaria* was first discovered as a British species in London and its fungus-eating larvae were probably not uncommon in parts of London during the last few years of the nineteenth century, but from 1906 to 1953 there are no London Area records. From then onwards there has been a steady trickle of records in all years except 1967, 1984 and 1986, but the moth has always been rare in that period and largely restricted to our part of Surrey. Since 1996, however, there appears to have been a sudden and drastic increase in numbers and the moth is very clearly extending its range towards the north.

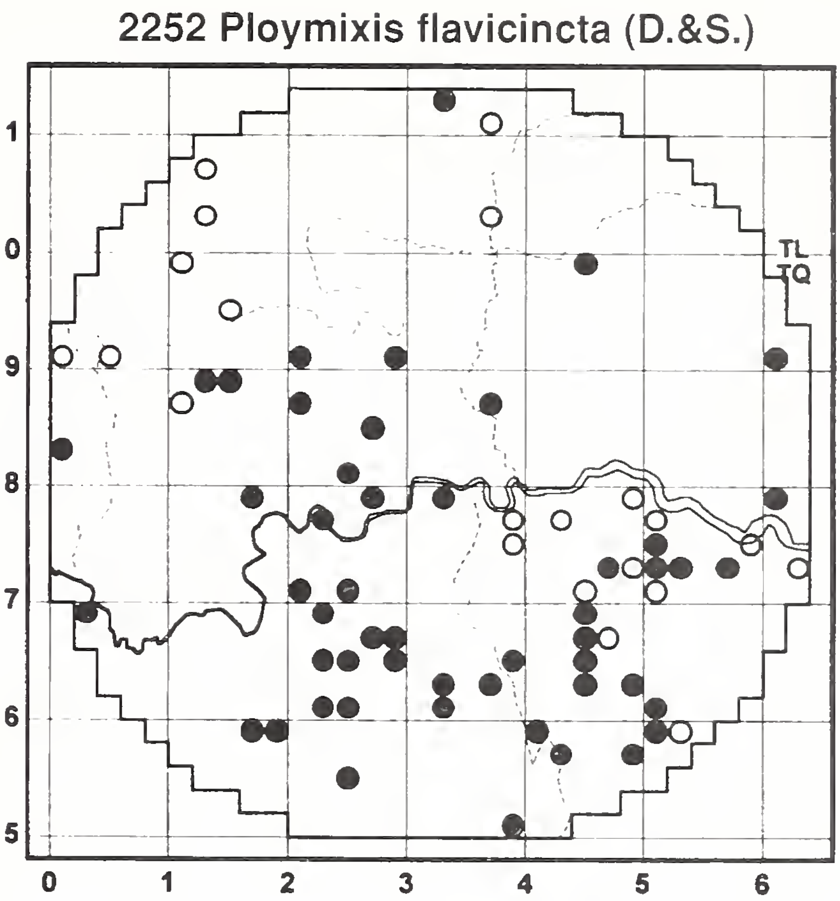

FIGURE 3. Distribution of the large ranunculus *Polymixis flavicincta* in the London Area.

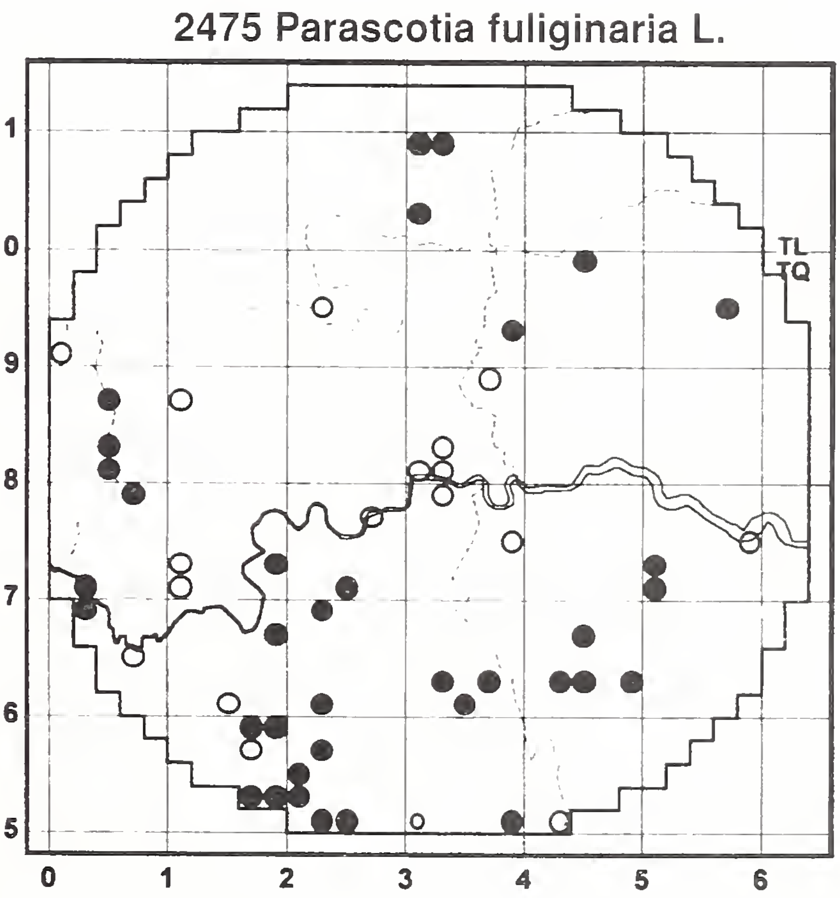

FIGURE 4. Distribution of the waved black *Parascotia fuliginaria* in the London Area.

There are now current records from 35 of the tetrads in the London Area — more than double the fifteen included in *LMLA*. A revised distribution map is clearly necessary and this is now presented as Figure 4.

To complete this brief discussion of spreading species during 1997 and 1998, the black arches *Lymantria monacha* must also be mentioned. The pattern of dots on the distribution map in *LMLA* showed a relatively widespread species, but it was always numerically uncommon and most certainly absent from a great many site lists that had been built from a considerable amount of effort. During 1997, and more so during 1998, this attractive moth started to appear at garden light-traps — traps that had been operated for several years on practically every night of those years — where it had not been noted before. It is difficult to understand why a moth whose larvae feed on oak should suddenly become significantly more numerous. A revised distribution map is presented as Figure 5.

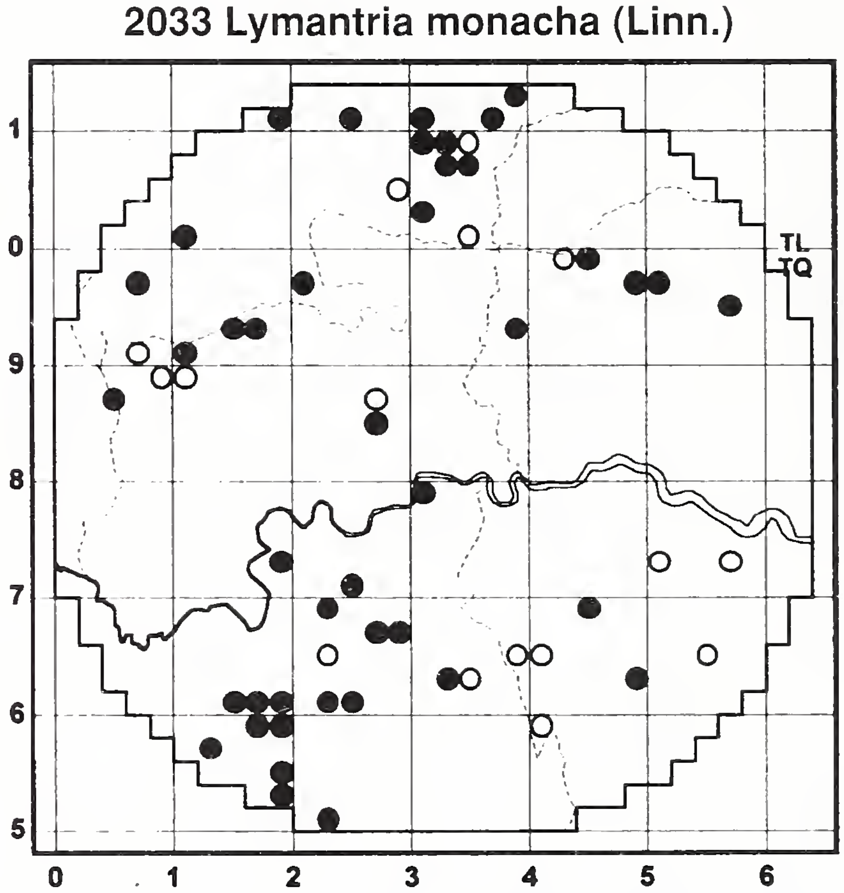

FIGURE 5. Distribution of the black arches *Lymantria monacha* in the London Area.

Declining species

It is often easier to detect new species than it is to realize that 'regulars' are becoming less common. Often such traits go undetected by individual observers until it is too late to plot the decline. On the other hand, a recorder who regularly receives 'total lists' from many sources is often better placed to spot these things. Thus, it is perhaps worth placing on record the fact that of over a hundred 'complete' garden lists received for 1997 and 1998 in the London Area the mottled rustic *Caradrina morpheus* features on extremely few. Is this species in decline?

Immigration summary

LMLA lists all reported records of immigrant Lepidoptera within the London Area to the end of 1991, and records reported for years subsequent to 1996 are listed by Plant (1995, 1997). The following summarizes records received for 1997 and 1998 together with a few late reports for earlier years.

YPONOMEUTIDAE

Diamond-backed moth *Plutella xylostella*: Orpington, West Kent, 22 April (3), 8 May (3), 12 May (3), 16 May (1), 20 May (1), 20 June (5), 7 July (2), 19 July (1), 5 August (1), 7 August (2) and 25 August (1) 1998 (I. Ferguson); Hampstead, Middlesex, from 20 July to 25 August then 2, 10 and 12 October, 1997 in low numbers on each occasion then 15 from 14 May to 25 August 1998 (R. A. Softly); Holland Park, Middlesex, recorded from 21 August to 23 September 1997 (T. Freed); Essex Filter Beds, South Essex, 3 on 8 May 1998 (D. Miller).

PYRALIDAE

Udea ferrugalis: Orpington, West Kent, 24 July (1) and 18 August (1) 1998 (I. Ferguson).

Palpita unionalis: Parliament Hill, Hampstead, Middlesex, one on 25 September 1997 (R.A. Softly).

PIERIDAE

Clouded yellow *Colias croceus*: Lippits Hill, South Essex, one on 1 August 1996, Sewardstonebury, South Essex, one on 3 August 1996, Sewardstone Marsh, South Essex, one on each of 6, 15 and 21 August 1996, Rammey Marsh, Middlesex, one on 8 August 1996 (A. Middleton); Three Mills Island, South Essex, one on 17 August 1996 (D. Miller); Bow Creek, South Essex/Middlesex, 29 August 1998 (D. Miller); William Girling Reservoir, Essex/Middlesex border, one on 7 September 1998 (P.Vines per A. Middleton).

NYMPHALIDAE

Red admiral *Vanessa atalanta*: Russia Dock, Surrey, 2 or 3 on 30 July 1996 (D. Murdoch); Ponders End, Middlesex, one on 6 March 1996, Sewardstone Marsh, one on 1 May 1996 with singles appearing again from 3 June to a peak of 7 on 30 July 1996, Lippits Hill, South Essex, one on 8 November 1996 (A. Middleton); Sewardstone Marsh, South Essex, one on each of 25 March, 31 March and 8 April 1997 then seen locally in ones or twos from 18 May 1997 into October with one at Enfield and another at Enfield Lock on 10 October 1997 (A. Middleton); Orpington, West Kent, one on each of 21 June, 17 September and 1 October, 1998 (I. Ferguson); Hounslow Heath, Middlesex, one in flight on 7 January 1998 (J. Herbert); Twickenham, Middlesex, one on 1 March 1998 (M. Nagle); Chelsea, Middlesex, one in flight on 13 February 1998 (T. Nodder/R. Pease); Twickenham, Middlesex, one on 1 March 1998 — sunning itself on a wall (M. Nagle); Barn Elms, Surrey recorded in butterfly transects from 30 April to 18 September 1997 (R. Bullock); Hampstead Heath, Middlesex, 96 sightings from 30 April to 18 October 1997 and 72 sightings from 13 February to 20 October 1998 (J. Maxwell); Cannon Hill Common, Surrey, one on 1 July 1997 (R. Kettle); Bushey, Surrey, one on 17 September 1998 (R. Kettle and P. Sellers); Wimbledon Common, Surrey, one or two — 8 and 25 July and 8 August (R. Kettle); Beddington, Surrey, one on each of 8 July, 16 August, 4 September and 29 September, 1997 (F. Lockwood); Cannon Hill Common, Surrey, one on each of 9 March, 24 June and 7, 10 and 21 July 1998 (R. Kettle); Wimbledon Common, Surrey, one on 13 August and 2 on 15 October 1998 (R. Kettle); Raynes Park, Surrey, one on 17 September 1998 (R. Kettle); Banstead, Surrey, one on 7 February 1998 (S. Gale); Enfield area, Middlesex, 15 March (1), 18 May (1), 9 June (1), 21 July (2), 6 September (2), 8 September (1), 20 September (1) and 19 October (1) in 1997 then, in 1998, 5 June (1), 20 June (3), 8 August (1), 7 September (1), 11 September (1), 12 September (1), 14 September (2), 17 September (1), 18 September (2), 23 September (1), 25, 26, 27 and 30 September (1 on each date) and 8 October (1) (R. Callf); Trent Park, Middlesex, 31 May (2), 10 July (1), 23 July (2), 19 August (1), 30 August (1), 1 September (2) and 1 on each of 4, 6 and 8 September 1997 then in 1998, 14 September (3), 26 September (1), 8 October (1) and 1 November (1) 1998 (R. Callf).

Painted lady *Cynthia cardui*: Surrey Docks, Surrey, 2 on 30 July 1996 (D. Murdoch); Russia Dock, Surrey, one on 30 July 1996 (D. Murdoch); Hampstead Heath, Middlesex, one on 4 June 1997 and seven sightings in 1998 from 27 April to 24 September, including a fresh adult on 12 September and no larvae found (J. Maxwell); Barn Elms, Surrey, one on 24 June 1997 (R. Bullock); Enfield area, Middlesex, one on each of 1 and 4 September 1997 (R. Callf); King George V Reservoir, Lea Valley, Essex/Middlesex border, one on 7 August 1997 (R. Cope per A. Middleton) and one on 14 September 1998 (A. Middleton); Enfield, Middlesex, 24 May (1), 16 June (1), 22 June (1), 3 July (2), 4 August (1), 14 September (1) and 17 October 1998 (R. Callf).

GEOMETRIDAE

Vestal *Rhodometra sacraria*: Orpington, West Kent, 2 on 1 September 1998 (I. Ferguson); North Chingford, South Essex, one on each of 1 and 2 September 1998 (B. Pateman); Theydon Bois, South Essex, one on each on 3 and 6 September 1998 (J. Green); Harrow, Middlesex, one on 3 September 1998 (J. Hollingdale); Buckland, Surrey, 12 May and 5 September 1998 (C. Hart); Wood Green, Middlesex, one on 1 September 1998 (M. Ashby); South Croydon, Surrey, 1 September 1998 (G. Collins).

The gem *Orthonama obstipata*: Halstead, West Kent, one on 14 July 1995 (J. East); Harrow, Middlesex, one male on 9 May 1998 (J. Hollingdale); Buckland, Surrey, 15 May, 21 July, 21 August and 9 September 1998 (C. Hart); South Croydon, Surrey, 5 July and 11 August 1998 (G. Collins); Colney Street, Hertfordshire, one on 20 July 1998 (P. Wheeler).

SPHINGIDAE

Death's-head hawk-moth *Acherontia atropos*: Chadwell Heath Station, South Essex, one on 26 September 1991 — in flight (D. Rear).

Convolvulus hawk-moth *Agrius convolvuli*: Bedfont, Middlesex, one dead on pavement in Mill Way, 29 September 1997 (W. Chester).

Bedstraw hawk-moth *Hyles gallii*: Theydon Bois, South Essex, one on 24 July 1990 (J. Green).

Striped hawk-moth *Hyles livornica*: North Chingford, South Essex, one on 7 June 1996 (B. Pateman).

Humming-bird hawk-moth *Macroglossum stellatarum*: Ickenham, Middlesex, one feeding on *Buddleja* flowers in garden on 5 September 1995 (M. Buckell); Tooting, Surrey, one on 19 March 1997 (L. Christie).

ARCTIIDAE

Orange footman *Eilema sororcula*: (? immigrant records). Halstead, West Kent, one on 19 May 1998 (J. East); Orpington, West Kent, one on 20 May 1998 (I. Ferguson).

NOCTUIDAE

Dark sword-grass *Agrotis ipsilon*: Halstead, West Kent, one on each of 6 and 8 June, 24 July and 27 October 1995, then one on 8 October 1996 (J. East); Hyde Park, Middlesex, one found dead on 17 July 1996 (T. Freed); Holland Park, Middlesex, one on 21 August 1997 (T. Freed); Parliament Hill, Hampstead, Middlesex, one on 12 August 1997 (R. A. Softly); Orpington, West Kent, one on 7 July 1998 (I. Ferguson); Essex Filter Beds, South Essex, one on 5 July 1998 and one on 8 July 1998 (D. Miller); North Chingford, South Essex, August 1998 (B. Pateman); Harlow, North Essex, 30 July 1995 (W. Last); Hampstead Heath, Middlesex, one on each of 20 September and 7, 22 and 24 October 1998 (R. A. Softly); Harrow, Middlesex, one on 18 May 1997 (J. Hollingdale); Stanmore Common, Middlesex, one on 18 May 1997 and one on 22 August 1998 (J. Hollingdale).

Pearly underwing *Peridroma saucia*: Hainault, South Essex, one on 13 October 1995 (C. Griffin); Halstead, West Kent, one on each of 5 and 11 June 1995 and 1 November 1996 (J. East); Hounslow Heath, Middlesex, one on 18 October 1997 (J. Herbert).

White-point *Mythimna albipuncta*: Theydon Bois, South Essex, one on 7 July 1997 (J. Green).

Red sword grass *Xylena vetusta*: Stanmore Common, Middlesex, one on 16 October 1998 (J. Hollingdale).

Small mottled willow *Spodoptera exigua*: North Chingford, South Essex, September 1998 (B. Pateman); Barnehurst, West Kent, one on 4 October 1998 (T. Steele).

Scarce bordered straw *Helicoverpa armigera*: Halstead, West Kent, one on 16 October 1995 (J. East); Theydon Bois, South Essex, one on 2 October 1998 (J. Green).

Bordered straw *Heliothis peltigera*: Halstead, West Kent, one on each of 13 and 17 June 1996 (J. East); Hyde Park, Middlesex, one on each of 11 and 18 June 1996 (T. Freed); Wimbledon, Surrey, one on 16 August 1996 (J. Dacie).

Silver Y *Autographa gamma*: Parliament Hill, Hampstead, Middlesex, eighteen trapped in the year on 19 May, 7, 14 and 16 June, 24 and 28 August then 2, 4, 7 and 25 September 1997, but no trap from 29 June and 17 July (R.A. Softly); Orpington, West Kent, 12 May (1), 20 May (1), 28 May (1), 30 May (2), 20 June (2), 19 July (1), 24 July (7), 7 August (1), 11 August (1), 15 August (1), 18 August (1), 20 September (1) and 25 September (1) 1998 (I. Ferguson); Hampstead Heath, Middlesex, twenty-three from 10 May to 1 October 1998 (R. A. Softly); Neasden, Middlesex, recorded from 25 June to 4 August 1998 (A. Self); Hounslow Heath, Middlesex, one in the trap on 20 October 1997 (J. Herbert); Harrow, Middlesex, recorded from 24 July to 6 October 1997 and from 9 January to 9 November 1998 (J. Hollingdale).

Microlepidoptera

Progress towards a complete listing of the microlepidoptera of Middlesex continues and a total of 761 species is now recorded. The project has at least one more year to run (year 2000) and so all records are invited. Whilst the Middlesex micro records are carefully checked and entered, however, records from county areas outside Middlesex are so few in quantity that they are better incorporated directly into the files held by the appropriate county recorders. All such records have been so forwarded and these are not analysed in this review.

Butterflies

There seems little point in duplicating the excellent efforts of the various branches of Butterfly Conservation which affect the London Area, particularly since they receive considerably more records than I do from a huge number of specialist observers. Accordingly, after extraction of data on immigrant species, all butterfly lists are now routinely passed to this organization. Readers are referred to the excellent annual report on butterflies in Hertfordshire and Middlesex produced by John Murray.

Vice-county analysis of records of larger moths received

V.C. 16, West Kent

The rediscovery of the small ranunculus *Hecatera dysodea* was doubtless the most important event in the West Kent vice-county during the period under review; this has been fully discussed above as has the feathered ranunculus *Polymixis lichenea*, another interesting moth that may be returning to the London Area — though unlike the small ranunculus it was not extinct in Britain. Brian West took a fresh specimen at his garden light in Dartford on 26 September 1997 to be followed by another the next night and a third the night after, all being males. This species is also discussed in greater detail above. Brian also made some most interesting discoveries concerning the life-cycle of the common carpet *Epirrhoe alternata* in Dartford, mainly concerning the timing of the various generations each year in different parts of the country. This review is not the place to analyse such data which may in any case be read elsewhere (West 1998).

Amongst the many species recorded by Paul Sokoloff in his garden at Green Street Green, Orpington during 1997, four species of larger moth stand out as deserving particular mention. The alder kitten *Furcula bicuspis* is a scarce moth in the London Area; one arrived at Paul's trap on 5 June 1997. There are now nine tetrads in the London Area where this moth has been seen in recent years, three of which are in the Kent sector and six in Surrey. Another pleasant surprise was a waved black *Parascotia fuliginaria* in the trap on 29 July. Although not new to the Orpington area, Paul's 1997 records of least carpet *Idaea rusticata* are of interest. The species usually has a single generation each year, with adults flying from the end of June or early July until about the third week of August; rarely there is a second generation later in the year. During 1997, an adult was taken at Orpington on the rather early date of 6 June and a fresh example was encountered on 25 September. This does suggest that there was a second generation in 1997, though the late date is not a record; that honour goes to one taken on 31 October 1984 — also at Green Street Green by Paul Sokoloff. Finally, a very fresh, pristine-condition red-green carpet *Chloroclysta siterata* was found resting on the moth-trap on 17 November.

The red-green carpet also turned up in Ian Ferguson's garden in a different location in Orpington, on 20 September 1998 and he, too, managed to catch a waved black — on 2 August 1998. However, one species which his garden produced that Paul Sokoloff's did not was the orange footman *Eilema sororcula*, an example of which presented itself on 20 May 1998. This brings the number of tetrads in the London Area where this species is reported in recent years to six (four were indicated in *LMLA*) and is only the second current location for our portion of West Kent. There is some feeling that some of the recent records of this species might relate to primary immigrants, for example, a specimen taken at Croydon, Surrey on 29 May 1992 by Graham Collins coincided in terms of date with many examples on the Dorset coastline. There does not seem to have been any immigrant activity involving this species on the south coast around the time of Ian Ferguson's record, but given the relatively well-recorded nature of the London Area, the ease with which the orange footman may be recognized and the fact that where this moth does occur as a resident it can usually be attracted in some number, it seems improbable that this species is persisting in some as yet undetected breeding colony. Possibly it is poised to colonize our area just as the red-green carpet and the waved black are now doing and all previously unreported records of this species in the London Area, as well as any future records, are particularly requested so we can keep track of this possibility.

If the records received are anything to go by, most lepidopterists are sedentary creatures. Lists from garden light-traps abound, but the senders never seem to go anywhere else! Ian Ferguson is a notable exception to this rule and he has sent me casual records from no less than seventeen separate localities in our West Kent sector for 1998. These have provided a large number of map dots for common species and, although these don't all warrant specific mention here, the records are extremely important. Some of the more interesting of these casual records include the barred rivulet *Perizoma bifaciata* at Jubilee Park, Petts Wood, where Ian also listed the sloe pug *Chloroclystis chloerata* and the chocolate-tip *Clostera curtula*. From the extreme south-east boundary of the LNHS recording area he also noted the sloe pug at Kemsing Down where an emperor moth *Saturnia pavonia* was also found, resting on flowers. Further in, at Shoreham rifle range, Ian found an orange underwing *Archiearis parthenias* in flight on 30 March and at White Hill, Shoreham, he noticed a dark umber *Philereme transversata* and the juniper pug *Eupithecia pusillata*.

A little to the east at Halstead, near Sevenoaks, John East has continued to trap moths in his garden and has made a number of interesting records. Red-green carpet and waved black are both reported for 1997, though neither is new in this year. New species for the garden and for the map tetrad include the currant pug *Eupithecia assimilata*, ash pug *E. fraxinata*, the puss moth *Cerura vinula* and the buff footman *Eilema depressa*. More important, however, was a black arches *Lymantria monacha* taken on 12 August. This is only the second recent location for the species in our portion of West Kent (of the two dots on the map in *LMLA*, one, that in tetrad 57B, is an error and should be an open circle), but this is another species which is spreading, as discussed above. Two further records stand out above the others, however. First of these was a male drinker *Euthrix potatoria* taken during 1997. For some reason, apart from my own 1991 records from Crayford and Dartford Marshes, this large and very distinctive species is apparently otherwise absent from the London section of West Kent and its appearance at Halstead is a total surprise. In adjacent Surrey the records are more or less confined to the peripheral areas and the moth clearly avoids the urban situation. Perhaps it is simply under recorded in the peripheral areas of West Kent? The other species of special note is the cloaked pug *Eupithecia abietaria*, an example of which was trapped on 11 June 1997. There was considerable immigration activity on the coast at this period, although the trap is situated only fifteen metres from a mature Norway spruce tree. The moth, which was discovered as British in 1845 at Black Park, Buckinghamshire, depends for its breeding cycle on spruce trees that are old enough to bear cones and in London was last noted as a singleton at light in 1986 at Dartford. The very few London Area records are all listed in *LMLA*. John East has also supplied me with some valuable phenological data which extends the recorded flight period in our area for nine species of moth. Notable amongst these was an ash pug on 30 April (18 May is the earliest recorded date in *LMLA*), nut-tree tussock *Colocasia coryli* on

31 March and 9 and 10 April (normally not flying until May), a very worn foxglove pug *E. pulchellata* on 19 July (normally in evidence in May and June, though there were partial second generations recorded in 1907 and 1976, and Ray Softly noted an example at Hampstead, Middlesex on 14 August 1993), a mottled beauty *Alcis repandata* on 24 September (normally finished by the end of the second week of August) and an engrailed *Ectropis bistortata* on 11 September (second generation typically over by late August).

During 1998, John added a further four species to his garden list, bringing his total to 358 macro species. First was an orange footman *Eilema sororcula* on 19 May, a scarce London species with only seven tetrads recorded in the post-1979 period. Of these, five are south of the Thames and three of these, including the present record, are in West Kent. There is some speculation that this might be an immigrant example (see Ian Ferguson's record, above). June saw a small elephant hawk-moth *Deilephila porcellus* on 21st and a little emerald *Jodis lactearia* on 30th whilst a pine hawk *Hyloicus pinastri* brought up the rear on 15 July.

Tony Steele has sent me several lists of moths recorded in the West Kent portion of the London Area, including from his garden in Barnehurst and from White Hill, Shoreham and a good many on both of these lists were new tetrad records. Most were scarcely of particular note, though a dusky-lemon sallow *Xanthia gilvago* on 4 November 1997 is not only a late date, but is also only the third recent record for our part of Kent. The following year he recorded a post-hibernation red-green carpet on 15 March and the immigrant small mottled willow on 4 October. From White Hill the 1997 highlights included the very under-recorded mottled grey *Colostygia multistrigaria* on 23 March, the speckled yellow *Pseudopanthera macularia* from 1 May to 1 June — with a total of six examples, and a pale pinion *Lithophane hepatica* on 13 November, whilst in 1998 two oak eggars *Lasiocampa quercus* were noted on 8 August. A glance at the map in *LMLA* shows clearly the strong Kent bias in records of this large moth.

Tony also sent me a list of fifty-eight moths encountered on a single session, on 20 July 1998, at Beechen Wood near Eynsford, all of which were new tetrad records in a previously unrecorded area. Notable amongst these were the barred hook-tip *Drepana cultraria*, the satin lutestring *Tetheella fluctuosa*, and chalkland associates, the fern *Horisme tersata*, the pretty chalk carpet *Melanthia procellata* and the scallop shell *Rheumaptera undulata* — the last a relatively uncommon species in our area.

To complete the round-up of Kentish records, several quite interesting moths were attracted to mv light in old woodland at Holwood Park, near Orpington on 8 July 1997 by myself. This marvellous area of ancient woodland and superb flower-rich meadow stretches over two tetrads, one very poorly recorded and the other not previously recorded at all. The more interesting moths included a few poplar lutestring *Tethea or*, a single satin lutestring *Tetheella fluctuosa*, a little emerald *Jodis lactearia* (only the seventh record for our area south of the Thames), several buff footman, a single suspected *Parastichtis suspecta* and, most surprising, two examples of the beautiful snout *Hypena crassalis*. The waved black was also recorded, but interestingly this was not in the moth trap; instead a single example made its way into my Malaise trap set up over dead logs at the woodland edge. Since it is known that the larvae feed on fungi under bark it is assumed that this was a freshly emerged adult from the logs below the trap. The trap period for this sample was 1–15 July 1997.

V.C. 17, Surrey

The discovery of pauper pug *Eupithecia egenaria* in the Dorking area has already been mentioned in the introductory part of this review, as has the capture of the crescent striped *Apamea oblonga* at Barn Elms on 7 August 1997.

In his garden at South Croydon, Graham Collins recorded a number of good species. The vestal was noted on 1 September 1998 and the gem on 5 July and

11 August in the same year. Red-green carpets were present in November 1997 and October 1998, whilst other apparently spreading species noted here included the black arches on 2 August 1998 and the waved black eight days later on 10 August. Netted pug *Eupithecia venosata* was noted on 5 June 1997 and 23 May 1998, yarrow pug *E. millefoliata* on 9 July 1997 and ochreous pug *E. indigata* on 17 May 1997. A pleasant surprise was the dingy footman *Eilema griseola* on 20 July 1998, a star-wort *Shargacucullia asteris* on 27 June 1997 and the coronet *Craniophora ligustri* on 28 July 1998.

At other sites in the London Area Graham also noted some good moths. The map-winged swift *Hepialus fusconebulosa* was one such example, recorded by him at Box Hill on 24 June 1998. This is only the seventh current locality for the moth in our area. At Esher Common on 9 October 1998 he noted larvae of the fox moth *Macrothylacia rubi*; this is a very local moth in our area and, apart from the Black Park, Buckinghamshire record mentioned later in this review, one which is now confined to Surrey having become extinct in the remainder of our area. Sloe carpet *Aleucis distinctata* is seemingly a difficult moth to find, but Graham managed to turn it up at Great Bookham Common on 31 March and 3 April 1998 which just goes to show what can be done if the generator is taken for a walk a little earlier than one might normally consider justified! Finally, to complete this summary of Graham's excellent recording efforts, he notes the yellow-legged clearwing *Synanthedon vespiformis* at Great Oaks, Oxshott and at Great Bookham Common, as well as the red-belted clearwing *S. myopaeformis* at Barnes.

The lists for Surrey sent by Mark Parsons for his garden at Raynes Park and for Ashtead Common covering the two years under review contained much of interest. At the former site the most exciting discovery was that of the triangle *Heterogena asella*, an example of which took Mark totally by surprise on 7 August 1998. This is discussed in more detail earlier in this review. A red-belted clearwing was also noted at Raynes Park on 16 July 1998. Other notables for 1998 at Raynes Park included the small seraphim *Pterapherapteryx sexalata*, only the fifteenth modern London Area record, the black arches, the buff footman, the wormwood shark, the small rufous *Coenobia rufa* and the waved black. On Ashtead Common during 1998 Mark took an orange moth *Angeronia prunaria* on 19 June. This is only the second current record for the whole LNHS area, the other being at Bookham Common in 1988 from where it has apparently not been seen since. There are no Surrey records given in Graham Collins' book for anywhere near the London Area so that these two modern records appear somewhat isolated. Approximately eight heart moth *Dicycla oo* were attracted to the Ashtead light on 19 June and there were about the same number of rosy marbled *Elaphria venustula* on the same night. Also of special interest at Ashtead was the capture of two dotted chestnut *Conistra rubiginea* on 17 March 1998. An example was also taken in Banstead during 1998 by Steve Gale and is mentioned below. In *LMLA* I listed all the known London Area records for this species and stated that this former extremely local resident might now be extinct here. Later, in my review of 1995 and 1996 (Plant 1997) I referred to a 1996 capture by Graham Collins in South Croydon whilst another was noted in the same year by Graham at Headley Warren. In his book *Larger moths of Surrey* (Collins 1997) Graham shows three further records and comments that the moth is most frequent in that county on the heaths of the Bagshot Beds, less commonly on other heaths and woodland in central and south-west Surrey. He continues to say that the occasional examples which appear further east (which would include those in our part of the county) may represent attempts to increase the species' range. It is not clear if the dotted chestnut is in fact a resident in our portion of Surrey but it does seem likely in view of the number of records. It seems wise now formally to promote it from its existing status category 7A (presumed extinct) to category 10 (species whose status is not clear) with a mind to the possibility that it ought perhaps to belong to category 4 (extremely local residents).

Sir John Dacie has now run a light-trap in his garden at Wimbledon for some forty-three years, having commenced operations in 1955. The fact that even he can still generate new species for his garden list should inspire others who may think that they have caught all that is there! Two late records for 1996 are the nut-tree tussock, taken on 27 July and, rather better, a clouded magpie *Abraxas sylvata*, on 20 July. This is quite some distance from the secret breeding location in Kent, but if the moth did not come from there it poses the question of whether or not there are other breeding sites, as yet undiscovered, for this elm-feeding species in our area. The black arches was also new, on 26 and 29 July 1996 and a bordered straw *Heliothis peltigera* was taken on 16 August. During 1997, a single new addition was the peacock moth *Macaria notata*, taken on 24 August whilst there was a repeat performance from the double line *Mythimna turca* on 15 July, doubtless a wanderer from Richmond Park.

Three new species were added to his Banstead garden list by Steve Gale during 1997. A single black arches was noted on 14 August, two white-line dart *Euxoa tritici* were taken on 10 August and a dog's tooth *Lacanobia suasa* was trapped on 17 August. Other species recorded were also of some interest. A plain wave *Idaea straminata*, taken on 30 June was only the second garden record whilst a peacock moth on 16 August was the fourth. The red-green carpet was again present and is clearly established in the area. Privet hawk-moth *Sphinx ligustri* was recorded for the second year in succession with a singleton on 5 June whilst pine hawk-moth is now regarded as an annual species here. The rosy footman *Miltochrista miniata* was noted on 23 June and was only the second record for the garden as was the coronet *Craniophora ligustri*, trapped on 14 July. A waved black appeared on 16 July. A number of other sparsely recorded species here in 1997 included the dark spinach *Pelurga comitata*, small yellow wave *Hydrelia flammeolaria*, pebble prominent *Notodonta ziczac* and oak nycteoline *Nycteola revayana*. During 1998 another three new species were added, bringing his total garden list to 369 species of macro moth. May saw the first addition, with a dotted chestnut on 8th; this has already been included in the discussion above. In the same month a May highflier *Hydriomena impluviata* on 19th was also new to the garden, as was a single rosy marbled on 18 July.

A very welcome list of fifty-eight species of larger moth has been sent by Geoff Martin from his trap at Kinglake Street, SE17. This very urban area, near the Elephant & Castle, is almost completely devoid of any sort of habitat that could support moth larvae and is truly just about as urban as it is possible to be. It is fascinating to look at the species which do occur there and, in particular, to see what features they may have in common that permit them to survive in such places. Species such as the bordered pug *Eupithecia succentureata*, whose larvae are recorded in London on *Artemisia* species, and the plain pug *E. simpliciata*, whose larvae are recorded here on Chenopodiaceae, clearly have a ruderal habitat association; on the other hand species such as the green pug *Chloroclystis rectangulata* and the brimstone moth *Opisthograptis luteolata* feed as larvae on rosaceous bushes such as *Crataegus monogyna* and *Prunus spinosa* which grow in one or two places and may be used as hedge plants. Small areas of land not currently in human use (I refuse to use the term 'wasteland' as it implies that such land has no value in its present state) support small stands of rose-bay willow-herb *Chamerion angustifolium* — the larval foodplant of the large ranunculus, which is also on Geoff's list.

From Hurst Green, on the southern edge of the LNHS recording area, a long list of moths encountered during 1998 has been supplied by Phil Jones. Unfortunately he was away for much of that year and the trap was run only on ten occasions in February, March, May, June, July and September. In spite of this almost all the moths were new tetrad records for the maps and a good proportion were also new to ten-kilometre square TQ35. Inevitably, the bulk were common species, but amongst the more noteworthy were three alder kitten *Furcula bicuspis*, with one on 13 May and two on 6 June, a blossom underwing *Orthosia* *miniosa* on 31 March, both the grey *Acronicta psi* and the dark *A. tridens* daggers, three tawny pinion *Lithophane semibrunnea* on 31 March and a waved black on 27 July. All in all not a bad list for only ten nights of trapping. Phil also sent several casual records from other southern tetrads and added many useful dots to the distribution maps.

A large number of moths captured in his Buckland garden by Colin Hart, at the extreme edge of the LNHS recording circle, are of particular interest. The pale eggar *Trichiura crataegi* is already recorded from his tetrad and this is in fact the only locality for the moth in the London Area; the moth showed itself still to be present on 8 September 1998. Vestals *Rhodometra sacraria* put in an appearance on both 12 May and 5 September 1998, whilst that other occasional migrant the gem *Orthonama obstipata* appeared on 15 May, 21 July, 21 August and 9 September, also in 1998. Red-green carpets were present in October of both years and a scallop shell *Rheumaptera undulata* was recorded on 15 July 1998. The ochreous pug *Eupithecia indigata* is, like most pugs, probably very much under-recorded in our area, but this one, at least, is likely to prove to be as locally distributed as the map in *LMLA* suggests. Colin had one in his trap on 12 May 1998 — the fourth recent record for our Surrey sector. Pine hawks appeared in June of both years and the black arches in July of each. The heath rustic *Xestia agathina* is hardly one of our commonest moths — the map in *LMLA* showed only a single recent record, and that for Kent. Adults at Buckland on 16 August 1997 and 13 August 1998 suggest that it may be overlooked in appropriate habitat in the very edge of our area, although these could perhaps represent wanderers from just outside our boundary. Another good moth here was the double kidney *Ipimorpha retusa*, noted on 3 August 1998 and only the second recent London Area record. Webb's wainscot *Archanara sparganii* was another very good moth, with a singleton on 3 August 1998, whilst the waved black is clearly resident there with adults at light in July of both 1997 and 1998.

Paul Wheeler encountered the chalk carpet *Scotopteryx bipunctaria* at Betchworth Quarry, flying in sunshine on 27 August 1998 and Roy Palmer encountered the same species at Beech Plantation, Oxted on 1 August in 1997. This local and uncommon species barely creeps into our recording area and has vanished from many sites including all of those on the North Downs in Kent. There are now six post-1979 tetrad records for the species, all in Surrey in the extreme south of our recording circle.

Roy also recorded the royal mantle *Catarhoe cuculata* at Dome Hill, Caterham on 2 July 1998, updating an old tetrad record to give us eight current London Area sites for this species. He also noted juniper carpet *Thera juniperata* at the same site on 12 October 1997, whilst Laurie Christie recorded an immigrant humming-bird hawk-moth at Tooting on 19 March 1997.

A number of other Surrey records have also been received, including lists for the Croydon area from Hutchinson's Bank, Chapel Bank, South Norwood Country Park and Heathfield, all made by Martin Wills and passed to me by Mathew Frith of the London Wildlife Trust. All are very valuable contributions and include a number of new tetrad records.

V.C. 18, South Essex

We start this section with a belated record of a death's-head hawk-moth recorded at Chadwell Heath Station on 26 September 1991. This was noted by David Rear as it alighted on the platform briefly before flying up to rest on a roof support as it started to rain. As David was on the return journey from twitching a red-backed shrike he had his binoculars with him and so was able to view the moth well for some time.

From the Essex Filter Beds Nature Reserve in the Lea Valley, literally on the border with Middlesex, David Miller has sent an impressive list of 125 moths for 1997 of which some 103 represent new records for the tetrad. Amongst the bulk of common and more-or-less mundane species, which are nevertheless of interest this close to the centre of the urban zone, a few of greater note stand out for attention. Six species, namely satin wave *Idaea subsericeata*, scarce footman *Eilema complana*, garden tiger *Arctia caja*, black rustic *Aporophyla nigra*, pink-barred sallow *Xanthia togata* and double-lobed *Apamea ophiogramma*, all represent new ten-kilometre square records. The heart and club *Agrotis clavis*, with four recorded between 15 and 30 June is unusual north of the Thames, although not unexpected here since it is already recorded in the adjacent tetrad to the west. Some nice species characteristic of the habitats present in this part of the Lea Valley were also recorded, including southern wainscot *Mythimna straminea* (seven between 30 June and 5 September), obscure wainscot *M. obsoleta* (seven between 5 June and 11 July), mullein *Shargacucullia verbasci* (one on 26 May), the crescent *Celaena leucostigma* (four between 11 and 25 July), bulrush wainscot *Nonagria typhae* (three between 26 July and 5 September), Webb's wainscot *Archanara sparganii* (three between 11 July and 22 August) and fen wainscot *Arenostola phragmitidis* (two on 11 July). Perhaps the best of these was the Webb's wainscot, bringing the overall London Area distribution up to ten tetrads. The dotted fanfoot *Macrochilo cribrumalis*, already reported from this site, was found again in 1997 and was also located by David in the tetrad to the south at Walthamstow South Marsh. This brings the total number of London Area localities for this elusive insect to three.

Further east, at Theydon Bois, Jean Green continues to run a light-trap in her garden and had recorded a grand total of 318 macro species at close of 1998 with eight being added during each of the two years under review. During 1997, a particularly notable species was the wood carpet *Epirrhoe rivata*, a single example of which came to the trap on 3 August. This represents the second modern record for the Essex sector of the London Area and only the fourth for the London Area as a whole. Another example, on 24 July 1998, was seen by Brian Goodey, the Essex County Lepidoptera recorder, and its identity confirmed. The arrival of the phoenix *Eulithis prunata* was not unexpected, as this moth is clearly on the increase at present and is in any case widely, though thinly, recorded across the whole London region. Similarly, the red-green carpet, which was noted on 31 August was to be expected in view of its recent range expansion, and common species such as sloe pug *Chloroclystis chloerata* and garden dart *Euxoa nigricans* are notable only by their absence until now. The yellow belle *Semiaspilates ochrearia*, on the other hand, was a most unexpected surprise, with a single example on 14 August. In the London Area this moth is confined to the eastern sector, rarely far from the River Thames and this Theydon example must surely have been a wanderer from here? A rosy footman *Miltochrista miniata* on 8 July represents the first modern record for our London portion of Essex and, indeed, is only the fourth in our area north of the Thames, though it is perhaps not unexpected in the Epping Forest area generally. Finally, an immigrant species, the white-point *Mythimna albipuncta*, turned up as a singleton on 7 July to become only the seventh London Area record for all time. For 1998, new additions included an immigrant vestal *Rhodometra sacraria* on each of 3 and 6 September, the green carpet *Colostygia pectinataria* on 11 September, an oak-tree pug *Eupithecia dodoneata* on 4 June with another the next night — the only post-1970 records for our part of Essex — scarce footman *Eilema complana* on 17 July, tawny pinion *Lithophane semibrunnea* on 30 March, large ranunculus on 25 September a single example of rosy marbled on 18 June and two bordered sallow *Pyrrhia umbra* — with one on each of 10 and 31 July.

Over in Chingford, Bryon Pateman's garden list, also supplied from the Essex database by Brian Goodey, had climbed to 275 macros at the end of 1997, with ten added in that year. A red-green carpet came to the light on 23 October, but more interesting perhaps was a dark umber *Philereme transversata* on 16 July — a scarce moth north of the Thames, only the fifth in our Essex sector and a new ten-kilometre square record too. The great oak beauty *Hypomecis roboraria* is often reported in error when the pale oak beauty *H. punctinalis* is misidentified.

However, Bryon's record for 16 June falls neatly in as the fifth member of a line of five tetrad dots on the distribution map and is clear indication that this moth is locally established. Like the wood carpet and the dark umber, already mentioned, the light brocade *Lacanobia w-latinum* is more usually associated with the chalky soils to the south of the River Thames, in Surrey and West Kent. An example at Chingford on 3 May, however, though unusual, is not altogether out of keeping with the random appearance of single examples in places where it is unexpected. These may possibly represent wandering examples rather than an established local population, but it is odd that all of these unexpected moths are species normally associated with the chalk and that all should turn up in the same general area of Essex in the same year. Clearly there is still scope for new discoveries to be made. The wormwood *Cucullia absinthii* was noted in the trap on 16 July, the same date as the dark umber, which is itself of interest. The four remaining newcomers, angle shades, green carpet *Colostygia pectinataria*, small white wave *Asthena albulata* and plain golden Y *Autographa jota*, are quite unexpected, though the first mentioned is surprising in that it is only just added to the list after several years of trapping. A further nine species added in 1998 brought Bryon's garden total to 284 macros. These additions comprised immigrant vestals on each of 1 and 2 September, two dark spinach *Pelurga comitata*, in July and August, two lunar thorn *Selenia lunularia* — a species restricted to the north of our area — during May, spring usher *Agriopis leucophaearia* on 14 and 23 February, poplar kitten *Furcula bifida*, a black arches on 15 July, lead-coloured drab *Orthosia populeti* in April, two merveille du jour *Dichonia aprilina* in October, two suspected *Parastichtis suspecta* on 5 July and two waved black on 9 July. Elsewhere, Jean Green's son Tim recorded the buttoned snout *Hypena rostralis* at Magdalen Laver on 8 March 1998

Finally for South Essex during 1997 and 1998, Mrs Kathleen Black continues to record casually in her Barkingside garden and managed to encounter eight species new to her tetrad. Apart from the commoner ones, the most interesting was a yellow-legged clearwing, found during June 1997 and again in July 1998. This is only the fifth recent record of this surely under-recorded moth in the whole of the London Area and only the second for our part of Essex. It is interesting that the other Essex record was made within the confines of the same ten-kilometre square; thorough searching in the area at the appropriate time of year may well turn up some new sites for it. The female lays her eggs on freshly cut stumps of trees, preferring oak (but also accepting wych elm and sweet chestnut in the London Area), and it may be that recent changes in local forestry management are permitting this moth to increase. However, I am advised by Bernard Skinner that pupae are also sometimes found protruding from the bark of oak trees, so perhaps the larvae are less fussy than I had considered. Another London record is given in the section concerned with Middlesex, below.

V.C. 19, North Essex

No records of particular note have been received for this part of our recording area, though Bill Last continues to trap on a regular basis in Harlow and so continually adds to our overall knowledge of moths in the London Area.

V.C. 20, Hertfordshire

Rob Souter spent a night at Bayfordbury on 25/26 July 1997 and recorded a list of eighty-one species of larger moth. Most notable amongst these were the pine hawk-moth, only the third record for our part of Hertfordshire and only the seventh record for London north of the Thames, and the black arches, the fifth tetrad record for our part of Hertfordshire. Both of these species seem to have undergone a range expansion in the northern part of the London Area since publication of *LMLA* and these new records are not thought to be a consequence of earlier under-recording. Four other species, the barred red *Hylaea fasciaria*, the shark *Cucullia umbratica*, the Mother Shipton *Callistege mi* and the burnet companion *Euclidia glyphica* were also new tetrad records. The following year at the same site the white-spotted pug *Eupithecia tripunctaria*, brindled white-spot *Parectropis similaria*, white-pinion spotted *Lomographa bimaculata* and alder moth *Acronicta alni* provided new tetrad records.

Further west at Symondshyde Great Wood, Rob managed to record fifty-five species in 1997 of which no less than ten were new for the tetrad. Five of these — the large emerald *Geometra papilionaria,* the brown-tail *Euproctis chrysorrhoea*, the clay *Mythimna ferrago*, the slender brindle *Apamea scolopacina* and the beautiful golden Y *Autographa pulchrina* — are scarcely worth mention, but the other five are of more interest. The poplar lutestring is a very local resident in our area and the record of one at Symondshyde on 15 July is the first in the north-west sector of our recording circle. The pine hawk has already been mentioned; two on 15 July and another one on 21 July make Symondshyde Great Wood the fourth Herts-in-London locality. Two maple prominent were noted at light on 8 July and help to consolidate the pattern of distribution affecting the periphery of the London Area in the north-west sector. Records of the black arches are becoming more and more frequent and this is clearly a moth that is on the move. One came to light on 15 July. Finally, a buff footman, taken on 21 July is only the second in our part of Hertfordshire and only the fourth north of the Thames.

As an example of what can be done without the use of a modern light-trap, or indeed any other equipment, Rob Souter also recorded twenty-three species of moth in the stairwell of the CP Snow Building at the University of Hertfordshire Campus in Hatfield during 1997. Although none of these was especially exciting in the grand scheme of things, all were new records for a previously completely unrecorded tetrad and as such are of great value.

A 'moth evening' at Rowley Green Nature Reserve near Borehamwood, led by Colin Joiner, produced a list of thirty-one species of larger moth on 2 August 1997. Since this was a completely unrecorded tetrad all the records were new and it is earnestly hoped that many more will follow in future years. As might be expected from a short list obtained on but a single occasion, most species on the list were common ones that could reasonably be expected to occur. However, the evening did produce a black arches, further confirming the appearance of this species all over the northern part of the London Area.

A welcome new recorder to Hertfordshire is Alan Bolitho, whose light-trapping efforts in his garden at Cuffley during March to October 1997 produced a list of 164 species of which all but four were new tetrad records. Although the bulk of these are inevitably common species, the records are extremely helpful in filling in blank areas on the distribution maps. There were, inevitably, a few interesting species on the list. The barred hook-tip *Watsonalla cultraria* was noted and constitutes only the second record for our part of Hertfordshire, though this may be more due to under recording than any other reason. The least carpet is showing a steady expansion away from its main base along the East Thames Corridor and was also noted at Cuffley. A record of the flame carpet *Xanthorhoe designata* supports contention that this species is more widely distributed than originally thought. Records of the very local (in our area) species the chevron *Eulithis testata* and the dark marbled carpet *Chloroclysta citrata* are also noteworthy as was that of the juniper carpet *Thera juniperata*, the first for our part of Hertfordshire and only the fourth for London north of the Thames. This is a species worth looking out for as it appears to be expanding its range utilizing garden juniper plants to feed its larvae. Alan continued trapping during 1998 and added yet more new records to the total for his tetrad. These included the cream wave *Scopula floslactata*, the spruce carpet *Thera britannica*, great oak beauty *Hypomecis roboraria*, the gothic *Naenia typica* and marbled white-spot *Protodeltote pygarga*, whilst the red-green carpet made repeat appearances.

Maurice Pledger, Phil Jefferies and others have made a particularly useful contribution to our knowledge of southern Hertfordshire moths, principally through regular visits to the Huntsman public house in Lord Street near Hoddesdon during 1997! A light attached to a large oak tree outside this establishment is the real reason for their interest in the pub, of course! This lit tree trunk has been the source of a very large number of moth species, albeit mainly species already recorded. However, of the eighty-six species noted, seventeen are indeed new tetrad records and some of these are especially interesting. A red-green carpet was noted on 5 March, further evidence of the range expansion of this species reported in my last review. One of the greatest surprises, however, was the discovery of the great prominent *Peridea anceps* which put in a regular appearance between 7 April and 15 May. This most surprising record, which is beyond question, brings to seven the number of localities for this species in the London Area, only two of which, including the present one, are north of the River Thames. Another spring surprise was the discovery of the scarce prominent *Odontosia carmelita* which was observed between 14 and 29 April. This species also turned up at Stanmore Common, Middlesex in April 1998 (discovered by John Hollingdale). The only previous London Area records north of the Thames during the present century were at Bayhurst and Mad Bess Woods, Middlesex in 1988 and at Northwood, Middlesex in 1952. The moth is widespread, albeit rather thinly, in the non-urbanized parts of Kent and Surrey within our recording area. The alder moth *Acronicta alni* is probably under recorded and a record of this species at the Huntsman is the first for our part of Hertfordshire whilst the chocolate-tip was also noted bringing the number of Herts-in-London localities to four. The recent appearance of this species in a number of apparently new localities in Hertfordshire and Essex might reflect range expansion, but is more likely a consequence of increased numerical abundance of an under-recorded species so that the chances of encountering the moth are increased.

One tetrad to the west, Maurice and Phil recorded 137 macro species at Monks Green, in Broxbourne Woods, during 1997, of which 130 were new tetrad records. Several of these were of particular interest. Nine species recorded as new to the tetrad consolidate a pattern of distribution which includes a cluster of records in the Broxbourne Woods area generally; these are the poplar lutestring *Tethea or*, the birch mocha *Cyclophora albipunctata*, the great oak beauty, *Hypomecis roboraria*, the brindled white-spot, the marbled brown *Drymonia dodonaea*, the rosy footman, the pine beauty *Panolis flammea*, the merveille-du-jour *Dichonia aprilina* and the nut-tree tussock. Yet another pine hawk-moth here also supports a cluster-pattern, though this affects the northern edge of our recording circle suggesting a strong establishment of this species in central Hertfordshire northwards. I have personally taken the moth in my garden at Bishop's Stortford and at Therfield Heath on the border with Cambridgeshire during 1998. Other important 1997 records from Monks Green include a red-green carpet on 18 October, a peacock moth *Macaria notata* on 7 August (the first in our part of Hertfordshire and only the fifth for London north of the Thames), a bordered beauty *Epione repandaria*, a buff footman, the alder moth and the waved black — the first for the London portion of Hertfordshire, at light on 1 August.

The waved black also turned up at Great Groves Wood, Bayford, in the next tetrad to the west, during a light-trapping session on 19 July 1997 organized by John Dawson, the Conservation Officer of the Cambs. and Essex Branch of Butterfly Conservation. As this is a previously unrecorded tetrad all forty-four species were new. The highlights included the black arches, the suspected and the waved black, already mentioned, the second record for the London part of Hertfordshire.

During 1998, a good many new tetrad records were made in south-west Hertfordshire by Colin Everett, centred upon his garden at Garston, near Watford. Twenty-four new species were added to his garden list during the year bringing the total confirmed number of macros in the tetrad to 151. Amongst the scarcer London species was the maple prominent *Ptilodon cucullina*, a new ten-kilometre square record which reinforced the existing pattern of distribution for this species in the Hertfordshire sector of London; one came to the trap on 20 June. Elsewhere in the tetrad the Mother Shipton was noted for the first time. Amongst the more frequently found London moths were the least carpet on 25 July and a flame carpet *Xanthorhoe designata* on 23 June, the latter also constituting a new ten-kilometre square record. Perhaps more significant was a specimen of the gothic *Naenia typica* on 23 July; this is a new species for the London portion of Hertfordshire. Further locally distributed (Category 2A and 2B) species new to the tetrad were the dwarf cream wave *Idaea fuscovenosa*, the small dusty wave *I. seriata* (also a new ten-kilometre square record), the spring usher *Agriopis leucophaearia*, early moth *Thera primaria*, grey shoulder-knot *Lithophane ornitopus* (also a new ten-km record) brindled green *Dryobotodes eremita*, centre-barred sallow *Atethmia centrago* and bird's wing *Dypterygia scabriuscula*. Amongst species already recorded, but seen again during 1998, was a total of twenty-three heart and club *Agrotis clavis*, caught on ten nights between 20 June and 27 July, with a maximum of eight on 3 July. This is principally a Kent and Surrey species in London, but is also increasingly common in the north-west Middlesex/Hertfordshire border area.

Paul Wheeler made two trips with a lamp to Colney Street during 1998, on 20 July and 2 September. Fifty-seven species were noted of which fifty-three were new tetrad records. Most were, inevitably, common species, but amongst these was a double lobed *Apamea ophiogramma* — no doubt drawn from the reedbed area nearby and, somewhat away from its more expected area nearer the River Thames, a wormwood shark. The nearby wetland was doubtless also the source of four round-winged muslin *Thumatha senex*, but a single example of the gem *Orthonama obstipata* was certainly a primary immigrant. A slightly longer list was generated by Paul in nine nights' trapping during 1998 at Whippendell Woods, where the highlight must surely be the green arches *Anaplectoides prasina*, taken as a singleton on 18 June. Apart from one at Ray Softly's actinic trap at Parliament Hill, Middlesex, on 11 July 1996 this is the only record for the post-1979 period from north of the Thames in our area and the first ever for our portion of Hertfordshire. Other species of interest were the brindled white-spot on the same night, a pine hawk on 8 July and on the same night the second record of peacock moth *Macaria notata* for our section of Hertfordshire. Proper examination of males of the November moths caught revealed both common *Epirrita dilutata* and pale *E. christyi*; the latter is the first for the north-west of the London Area, though this is surely a consequence of so few recorders actually bothering to check specimens properly.

In Hertford, Andrew Wood's garden trap produced a goodly number of moths during 1998 of which a large number were new tetrad records. Several species of interest were amongst the list provided. The least carpet *Idaea rusticata* was one, providing a record at the most northern point in the London Area. The small dusty wave *I. seriata* was also noted, along with a mallow *Larentia clavaria*, the phoenix, the chevron and the inevitable red-green carpet. Of greater interest was a scarce tissue *Rheumaptera cervinalis* on 25 April. The only other recent record for this species outside the Surrey sector of the London Area is also for Hertford, with examples taken in 1994 and 1995 in the tetrad immediately to the west of here. The larvae feed on *Berberis* so larger gardens are as likely a place as any to look for this species in our region. Equally unexpected was an example of the marbled coronet *Hadena confusa*. This is only the second record of the species north of the Thames in our area. Many reports of this moth turn out to be the varied coronet *H. compta* which is rather more widespread and common in our area. However, Andrew's photograph of examples of both species side by side leaves no room for doubt in this instance. The V-moth *Macaria wauaria* has declined in recent years and has become a very scarce species in the London Area, possibly as a direct result of the demise of the allotment garden (the larvae feed on *Ribes* bushes). It was nice, therefore, to hear of one captured in Hertford by Andrew, again with an excellent photograph for confirmation.

Finally for the London portion of Hertfordshire, Alan Downie's trap in his garden at Waltham Cross produced a list of 120 larger moths during 1997 of which no fewer than thirty-two were new to the tetrad in which he lives. These included both segregates of the 'common rustic' *Mesapamea secalis* and *M. didyma*, as well as a number of the more-or-less common, but seldom reliably recorded, pugs. A chocolate-tip was amongst the other notable species, as was a dotted rustic *Rhyacia simulans* — a species which first appeared in the London Area in 1949, spread rapidly, but which now seems to have undergone a decline in the last few years. The lead-coloured drab *Orthosia populeti* was another newcomer as were the wormwood shark, the shark *Cucullia umbratica*, the mullein and the grey shoulder-knot *Lithophane ornitopus*.

V.C. 21, Middlesex

The north-western area of Middlesex is fast becoming one of the better-recorded parts of the London Area and this is in no small part due to the continuing efforts of John Hollingdale. From his garden in Harrow, John reports forty new species during 1997 (the second year of trapping) and a further twenty-five in 1998. Inevitably, many of these are common species and do not warrant particular mention in this review. However, several are of greater interest. The red-green carpet was mentioned in the review of 1995 and 1996 and maintains its presence in Harrow suggesting that here, as elsewhere, it has successfully established itself. John's diligence in sampling *Epirrita* species and passing them to me for critical examination has so far shown that all are the ordinary November moth *E. dilutata*, though sooner or later at least one of the others ought to turn up. He has also been sending me *Mesapamea* specimens and this has been more fruitful, with both the common rustic and the lesser common rustic now recorded (Remm's rustic *M. remmi*, which is perhaps an overlooked resident species in some parts of Britain, has not yet been recorded for the London Area, but is a further example of why records of *Mesapamea* species can no longer be accepted unless the genitalia have been properly examined). Chocolate-tips were recorded between 28 April and 29 May 1997 and a heart and club was noted on 19 June in the same year. The orange sallow *Xanthia citrago* was noted on 27 September and is proving to be quite widespread in the London Area generally. A nut-tree tussock on 19 July 1997 was also a new record for the ten-kilometre square TQ18, as was the spring usher *Agriopis leucophaearia* on 11 February 1998. The dotted rustic has evidently undergone a few years of scarcity, but has recently started to reappear at a number of former sites; at Harrow John Hollingdale captured a specimen on 1 October 1998. The spread of the large ranunculus into Middlesex from the south is evidenced by several recent records including one at Harrow on 18 September 1998 — the first here were taken in 1996. Another example was taken in Middlesex inside a house adjacent to Alexandra Palace by Alan Gibson on 24 September 1998. The spread of this species is discussed above. Finally, for Harrow, a single male of the immigrant species the gem was taken at light on 9 May 1998, and a single example of another immigrant, the vestal, was captured on 3 September in the same year.

John Hollingdale has also been recording moths in the Stanmore Common/Stanmore Country Park area. This site is spread over several map tetrads and John has very kindly provided separate lists for each so that the records can be properly mapped. Almost all the records are new for the various tetrads but perhaps the most interesting record was that of a red sword-grass *Xylena vetusta* which surprised John by arriving at his light on 16 October 1998 when a very strong south-westerly wind was blowing. This is the first Middlesex record since the 1880s and certainly relates to an immigrant example. Amongst the other species the black arches was noted between 14 May and 13 June 1997 and the merveille du jour was caught between 28 September and 18 October in the same year. This latter was also a new ten-kilometre square record for TQ 19 as was the bulrush wainscot *Nonagria typhae* on 7 September 1997. Sadly, as at Harrow, examination of a sample of *Epirrita* specimens proved all to be *E. dilutata*. Other important 1997 records included the light orange underwing *Archiearis notha* on 11 April, the northern winter moth *Operophtera fagata* from 4 to 14 November, and the peacock moth *Macaria notata* on 26 May — a rare moth in London north of the Thames, now noted from only seven tetrads in that region. During 1998 the red-green carpet put in yet another appearance on 9 May and is our first confirmed spring sighting in recent times (the species hibernates as an adult). Amongst the remaining more-interesting species in 1998 were the large emerald *Geometra papilionaria*, small brindled beauty *Apocheima hispidaria*, brindled white-spot *Parectropis similaria* and the suspected, all new ten-kilometre square records, as well as an alder moth *Acronicta alni* on 23 May, only the second record for Middlesex.

Another relative newcomer to moth recording is John Herbert, the warden at Hounslow Heath Local Nature Reserve. John's entomological efforts on the Heath cover the full range of insect groups and include operating a moth-trap from time to time. Almost all of his records are new for the tetrad so include many common species, but amongst those more noteworthy might be included in particular the six-belted clearwing *Bembecia ichneumoniformis*, taken from vegetation in a sweep-net on 12 July 1997. This is a moth which is probably overlooked in our area, as are many of the clearwing species. It has turned up recently alongside the Thames in the eastern half of the London Area and it is now evident that fairly vigorous sweep-netting of the foodplant *Lotus corniculatus* in the morning during July is an effective means of finding it. Those who only record by sitting around light-traps are unlikely to encounter it. Other useful 1997 Hounslow Heath records include the plain pug *Eupithecia simpliciata*, the lesser treble-bar *Aplocera efformata*, black rustic *Aporophyla nigra* and the streak *Chesias legatella*, and during 1998 there was the streamer *Anticlea derivata* on 29 April and 18 May, the grey Arches *Polia nebulosa* on 20 and 23 July and the double lobed on 9 July, amongst several others.

The red-belted clearwing is another species that is probably overlooked in our area; the larvae feed under the bark of old, and usually sickly, apple trees (pear is also recorded in London). Affected trees can be located by looking for empty pupal cases protruding from the bark in July and August and these often remain until the winter. Adults are best found on known trees between about 7 and 10 a.m. when they emerge and rest on the trunks before walking to the upper branches rarely to be seen again. Michael Zeffert found adults at Pinner on 22 June 1997. This is a fairly typical date. At my local site, in the apple trees outside the post office in Bishop's Stortford (outside the London Area), adults emerged on 23 June during 1997.

Whilst on the subject of clearwings, a yellow-legged was discovered by John Chainey on a window ledge in the Entomology Department of The Natural History Museum in South Kensington during July 1997. Although this seems an unlikely, if not highly suspect, location for this oak associate, it should be borne in mind that another example has been previously reported from the Malaise trap in the garden at Buckingham Palace, an equally urban site in the next map tetrad to the east. Whilst the origin of the South Kensington specimen is uncertain, the possibility that this apparently scarce representative of a grossly underworked group of moths is established somewhere in central London should not be totally dismissed.

In nearby Hyde Park (a historic location for yellow-legged clearwing, although there are no recent records), Tim Freed has been actively recording moths during the years 1993 to 1996, though his list was not received until too late for inclusion in the appropriate year reviews. A surprising wealth of species includes both common and lesser common rustic, the dog's-tooth *Lacanobia suasa*, a new ten-kilometre square record, and an immigrant bordered straw *Heliothis peltigera*, on each of 11 and 18 June 1996.

An equally good list of species for 1982 and 1993 to 1996 has also been recorded by Tim for Holland Park and in view of the urbanized nature of the area several of the normally common species are considered of interest. Some of the more surprising include the white-line dart *Euxoa tritici*, the autumnal rustic *Eugnorisma glareosa* and both the copper underwings *Amphipyra pyramidea* and *A. berbera*. The autumnal rustic also features on his list for Brompton Cemetery, where he took twenty-eight between 5 and 27 September 1997. In the same year, the cemetery also produced the minor shoulder-knot *Brachylomia viminalis* on 14 July and two examples of the plain wave *Idaea straminata*, one on each of 2 July 1993 and 30 July 1997. Finally, in his garden nearby at Penzance Street, W11 he captured the feathered ranunculus as a male on 8 September 1997.

Another new contributor to our biennial reviews is Brian Hone, whose records from Enfield were passed to me by Rob Souter of the Herts. and Middx. Branch of Butterfly Conservation, during the course of our regular exchange of information. The forty-seven listed species are all new to his home tetrad and include the oak eggar *Lasiocampa quercus*, a moth with a most strange distribution in two distinct clusters centred upon Kent and the Herts./Middx./Essex conjunction.

A good number of species were recorded at Burnt Oak during 1997 by Paul Wheeler, who has also taken the precaution of having specimens of difficult species examined critically to ensure that his list is accurate. His trap is another that was situated in a previously under-recorded tetrad, so again most of his records are new. More noteworthy species included the large ranunculus on 16 September and 8 October, the latter a worn example, but well within the expected flight period for the London Area. The following year a further twenty species were added including both common and lesser common rustics and the heart and club. Although this summary of Paul's garden records is rather short, his example in recording common species in under-recorded areas is shining and the many common species not mentioned here are just as important as the rarer ones.

Ray Softly's hard work and dedication in recording the moths of Hampstead were rewarded with nine new species during the two-year period — a quite remarkable number in view of the considerable effort already put into that area by him. During 1997, the birch mocha *Cyclophora albipunctata* was taken at the actinic trap on his balcony in Parliament Court on 5 August, a rather earlier than usual date for the second generation which typically appears from late August in the London Area. The phoenix appeared in the balcony trap on 22 June whilst towards the end of the year two red-green carpets arrived, one each on 3 and 8 November. The pale prominent *Pterostoma palpina*, previously recorded by me from the adjacent tetrad, finally made an appearance on the balcony on 1 June and the chocolate-tip was noted on 1 May — the first in the Hampstead area since one at Highgate prior to 1891. A scarce footman *Eilema complana* on 2 August is also a new record for the ten-kilometre square TQ28. The purple clay *Diarsia brunnea* was attracted to the trap on 26 June. A record of the dark spectacle, now, we are told, correctly referred to as *Abrostola triplasia* (I intend species 2449 *A. trigemina* in *LMLA* where I used *triplasia* for the ordinary, and very common, spectacle), on 29 August requires confirmation. Amongst species previously recorded are some which are quite interesting. The least carpet has appeared annually since its first showing here in 1990, but has only reached double figures in 1996 and 1997. This evidence strongly supports the notion that the recent upsurge in records of this species represent new colonization rather than earlier under recording. The annulet *Gnophos obscuratus* appeared again in 1997, on 2 August, suggesting that the species may be established as a resident on Hampstead Heath; other Hampstead records are for 20 August 1983 and 24 August 1990. If this is so (and confirmation is clearly needed before we can be certain), the breeding habitat affected will certainly merit special protection and enhancement as the only site for the species in London. One other possible site for this species in the London Area is at Petts Wood, Kent, where one was taken on 4 September 1988, but where it has not been found since. The upwards trend in numbers of black rustic *Aporophyla nigra* at Hampstead is now clear from Ray's records and these serve as a good illustration of the value of keeping such data. From the first appearance in 1993 when six were noted, numbers in the trap rose at first slowly and then more rapidly with nine in 1994, thirteen in 1995, twenty-one in 1996 and forty in 1997. Another species on the up, already discussed earlier in this review, is the large ranunculus. At Hampstead it arrived as a singleton in 1996 and rose to five in 1997, all between 26 September and 10 October. The limitations imposed by space prevent me from discussing all of Ray's interesting and important observations and conclusions for 1997 so I must restrict this year to three further species. The wetland species the crescent *Celaena leucostigma* put in a second appearance on 26 July — the first was on 13 August 1986. Hampstead Heath provides numerous wet areas supporting the foodplants though none of these is particularly extensive. Another wetland species, the large wainscot *Rhizedra lutosa*, was noted again on 22 September and is thought, perhaps, to breed in the stand of *Phragmites* established at Highgate Pond in the 1970s. Finally, the blackneck *Lygephila pastinum* was recorded on 27 June; the foodplant, *Vicia cracca*, grows on Pryors Field some 300 yards from the trap site. During 1998 a rather surprising addition was the small fan-footed wave *Idaea biselata*. Quite how this escaped detection until now is a mystery. More interesting was a narrow-winged pug *Eupithecia nanata* on 21 May, an apparently scarce species in our area though like most pugs probably under recorded. Larvae are recorded on heather *Calluna vulgaris* in the London Area and Ray's record is the first for Hampstead this century. A single light brocade *Lacanobia w-latinum* appeared at the light on 1 June; this is quite a scarce species in the northern half of the London Area, being much more at home on the chalky soils in Kent and Surrey. Other moths of interest included a wormwood shark on 7 August and a tawny pinion *Lithophane semibrunnea* on 30 March. The moth year ended, as it properly should, on 31 December, when a single dark chestnut *Conistra ligula* was the only moth in the trap.

Further west, Andrew Self ran a trap on the window ledge of his flat overlooking the Brent Reservoir during 1998. This unlikely situation for a moth-trap revealed no less than ninety-eight species of larger moth during the year of which seventy-three were new records for that tetrad. These included a scalloped hook-tip *Falcaria lacertinaria* on 28 July, a species that shuns the urban area in general. Another such country-lover is the scorched carpet *Ligdia adustata*, which came to the window-ledge trap on 17 August. The heart and club *Agrotis clavis* on 3 July is not generally common this far north of the Thames though other records from recent years surround this general area of Middlesex and the moth is evidently established here at low density. The autumnal rustic appeared twice, on 11 and 19 September, and another uncommon species in that part of London was the shears *Hada nana* on 7 June. A moth which is perhaps more frequently encountered now than ten years ago is the wormwood shark; one turned up in Andrew's trap on 19 July whilst the large ranunculus appeared on 28 September. Later in the year, a dusky lemon sallow *Xanthia gilvago* was noted on 12 October, only the fifth modern record for Middlesex.

Amongst several more-common species encountered in the Enfield area by Robert Callf during 1997 the most noteworthy was the oak eggar *Lasiocampa quercus*, of which a male was found dead by the roadside near the Hadley Road Pumping Station on 8 August. In the London Area as a whole, the distribution records for this large species form two vague groupings, one occupying the outer half of our portion of West Kent and the other centred on the border between Hertfordshire and Middlesex towards the Essex boundary. The Enfield record falls into this latter area.

Elsewhere in Enfield, Anna Hughes and Charles Wilkins continue to trap in their garden at Bagshot Road. Several interesting species were noted in the period under review. During 1997 the December moth *Poecilocampa populi*, the lobster *Stauropus fagi* and the white-line dart *Euxoa tritici* were all encountered for the first time; the December moth and the white-line dart are also new records for the ten-kilometre square TQ39. In 1998, a pale oak beauty on 15 May was new to the area.

The loss of Ched George from Middlesex to Buckinghamshire is a serious blow to moth recording in the former county area, but he made a return visit to the Ruislip area in 1997 for a moth-trapping event run as a part of the celebrations for the long-overdue declaration of Ruislip Woods as a National Nature Reserve. Two species recorded stand out as particularly important. The peacock moth *Macaria notata* is distinctly scarce in London north of the River Thames and had not been previously reported in the Ruislip area. This brings the number of localities for this moth in the northern sector to seven, of which five are in Middlesex, one in Hertfordshire and one in South Essex. Rather more interesting, perhaps, was the capture of the least black arches *Nola confusalis*. There are only two previous Middlesex records of this small moth, the last being one at rest on a tree in Hyde Park during April 1923. The present-day distribution in the London Area involves several localities in Epping Forest, Essex, and a group of scattered localities on the outer edge of the London Area in Surrey.

Finally for Middlesex, Mr W. H. Chester found a live convolvulus hawk-moth *Agrius convolvuli* on the pavement in Mill Way, Bedfont, on 29 September 1997 and was kind enough to send in the record to the London Natural History Society via the Society's secretary.

V.C. 24, Buckinghamshire

The two years under review have generated some very interesting records from this relatively small and generally poorly recorded portion of our area. These are principally courtesy of Roger Haywood, who has very kindly sent me his list of new species records from Black Park. This list includes no less than twenty-nine new tetrad records and several of these are recorded for the first time in our small part of vice-county 24. During 1997, several exuviae of the large red-belted clearwing *Synanthedon culiciformis* were noticed protruding from birch stumps on heathland on 28 May — only the fourth post-1980 record for the London Area and the first for our part of Bucks., though this is surely an under-recorded species. A fox moth *Macrothylacia rubi* on 16 May was the first modern record for our area north of the Thames, all other current records being congregated in Surrey. Other noteworthy new records included the oak lutestring *Cymatophorima diluta*, yellow horned *Achlya flavicornis*, autumnal moth *Epirrita autumnata* (confirmed by genitalia), the lesser treble-bar *Aplocera efformata*. The following year, 1998, saw another species more typically associated with the southern part of our area in the form of the early tooth-striped *Trichopteryx carpinata*, though the record for Black Park on 29 March is actually the fourth north of the Thames since 1980. The four-dotted footman *Cybosia mesomella* was noted on 19 June; apart from two tetrads in Epping Forest this species has long since been absent from the bulk of our area, the only recent records, like those of the fox moth, being from Surrey. Finally, the lesser common rustic was confirmed as present — identified by dissecting genitalia.

The only other records received for our part of Buckinghamshire vice-county are of the speckled yellow *Pseudopanthera macularia* at Gladwin's Wood on 14 May 1998 and the burnet companion at Rush Green on 10 June 1998, both reported by David Rear.

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References

AGASSIZ, D.J.L. and SPICE, W.M. 1998. The return of the small ranunculus. *Entomologist's Rec. J. Var.* **110**: 229–232.

BRADLEY, J.D. 1998. *Checklist of Lepidoptera recorded from the British Isles.* Bradley and Bradley, Hants and Glos.

BUCKELL, M.B. and PROUT, L.B. 1898. The fauna of the London District: Lepidoptera. *Trans. Cy Lond. ent. nat. Hist. Soc.* **8**: 51–63.

COLLINS, G. 1997. *Larger moths of Surrey.* Surrey Wildlife Trust.

KARSHOLT, O. and RAZOWSKI, J. 1996. *The Lepidoptera of Europe: a distributional checklist.* Apollo Books, Stenstrup.

PLANT, C.W. 1993. *Larger moths of the London Area.* LNHS.

PLANT, C.W. 1995. A review of the butterflies and larger moths of the London Area for 1992–1994. *Lond. Nat.* **74**: 145–157.

PLANT, C.W. 1997. A review of the butterflies and moths (Lepidoptera) of the London Area for 1995 and 1996. *Lond. Nat.* **76**: 157–174.

WARING, P. 1999. The national recording network for the rarer British macro-moths. *Atropos* **6**: 19–27.

WEST, B.K. 1998. *Epirrhoe alternata* Müll. (Lep.: Geometridae): life-cycle in south-east England. *Entomologist's Rec. J. Var.* **110**: 149–152.

Book review

The mammals of Essex. John Dobson. Illustrated by Richard Allen, George Brown, John Cox, Alan Harris and Richard Hull. The Nature of Essex Series No. 2. Lopinga Books Limited, Essex. 1999. xi, 229 pp. £17.50. ISBN 0 9530362 1 9.

The last book on the mammals of this county was published just over one hundred years ago, so a new publication is certainly merited. The author is a well-known mammalogist, especially for his long-standing work with British bats, and he has obviously put in an extremely large amount of both desk and field work to produce this work. A team of five artists has been used to produce attractive line drawings of each species. The illustrations by John Cox are, however, of exceptional detail and quality.

Field work for the book began in January 1994 and, to have completed the project in less than six years, means that the tetrad maps used to show species distribution are fully up to date, in marked contrast to the thirty-one-year recording period of the national atlas. This means that the maps are a useful conservation tool, especially as all the original records are now fully accessible on a computer database. A few of the rarer species, such as cetaceans, quite reasonably use the period of 1980–1999 to define recent records. The county is large, including metropolitan Essex, but a glance at the distribution map for grey squirrel confirms that a high level of coverage has been achieved.

The book comprises an introductory chapter, a section on the fossil mammals of Essex, information on mammal habitats in the county and a valuable summary of mammal conservation work. The bulk of the publication, however, comprises a systematic review of all species, past and present, together with a background summary for each order covered.

Finally, the Essex Species Action Plans for the pipistrelle, brown hare, water vole, common dormouse, harbour porpoise and otter are reprinted in full at the end of the book to emphasize the mammal conservation work being undertaken in the county.

In total 61 mammal species (48 terrestrial and 13 cetaceans) have been recorded in Essex during the last 200 years. No less than 51 of these have been recorded since 1980. Twelve species are thought to be increasing, 12 species are stable and 13 species considered to be declining, with the remainder being too rare, or occurring only as vagrants, to comment on their status. Five of the 12 increasing species are aliens and, of the Biodiversity Action Plan species, only the otter is thought to be increasing. Unfortunately, of the seven resident bat species, only two are believed to be stable (Daubenton's and brown long-eared bats), whilst the serotine is considered likely soon to become extinct in Essex.

Clearly there is much urgent work to be done to secure a future for the mammals of Essex in the next century and this book will help to raise their profile, promote their future recording and assist with their conservation. John Dobson is to be congratulated for his dedication in carrying out so much new field work in a short period and for producing such an attractive publication which will become a standard reference for many years — although we must hope that it does not take over a century before someone with John's enthusiasm and commitment to mammals takes up the enormous challenge to produce the next update. This book should form a standard model for other counties considering the production of a mammal atlas project.

CLIVE HERBERT

Book review

The nature of Fife. Wildlife and ecology. Edited by Gordon Corbet for the Fife and Kinross Branch of Scottish Wildlife Trust. 1998. Scottish Cultural Press, Edinburgh. 243 pp., paperback. £14.95. ISBN 1 84017 008 5.

As a very limited student of ecology I find this book really opens up one's understanding of the interaction of the wide range of natural phenomena within the many different ecosystems that occur in Fife and elsewhere.

The introduction stresses the need to avoid a superficial approach to any habitat, but to examine its history, looking at the geological structures, considering how time, the elements and man and all the different organisms, sights, and sounds interplay in any given environment.

Each chapter becomes an effective and detailed guide to the wide mosaic of the different habitats in Fife. The geographical and geological chapter traverses time, explaining the formation of hills and landscape, the development of carboniferous rock, the 'Old Red Sandstone', the effects of the Highland boundary fault, just north of Fife, and the Southern Uplands fault, just south, between which Fife has subsided and the ultimate effects of all this on the ecology and economy of the region. The student of geology could use this book to plan a geological tour of the area. The descriptions are detailed, graphic and specialized but constantly stimulate interest to know and see the areas and formations for oneself.

Other specialists have carefully researched and written practically on every possible ecological niche or habitat to be found in Fife and they all make illuminating reading and provide comprehensive data on climate, cultural and ecological history of the many habitats encountered there; there are fascinating 'guides' to the long shoreline of cliffs, sand dunes and sandy beaches, the intertidal zones of the Tay, Forth and Eden estuaries, complete with wildlife, from tiny organisms to the haunting sight and sounds of the many seabirds found in these habitats. The flora is also carefully listed and described for most areas and anyone who is naturalist-inclined, be he or she botanist, birdwatcher, entomologist, marine biologist, ecologist, lay-person or other, should get a copy of this book, first as a very good read in all that will interest them, and then, like myself, they will find it a lure to follow up to Fife to explore the habitats for themselves.

The typical 'den' valley forests, beautifully illustrated and described are places that must be seen. The rivers, burns, ponds with all their immediate and adjacent plants, sound like a botanist's dream as do many of the nature reserves, e.g., Tentsmuir Forest, a National Nature Reserve area, which was afforested with Scots and Corsican pine after the First World War 'on a large area of fixed dunes and where there are populations of creeping lady's tresses *Goodyera repens*' — 'and much of botanical interest'; also there are 'pipistrelles, brown long-eared bats and Natterer's bats', etc. Another NNR is the Isle of Mey in the Firth of Forth which is a 'spectacular' seabird breeding site 'with substantial breeding colony of grey seals'. Grassland and woodland, fens, bogs, mires, their fauna and flora are all carefully described, as are details of the intensive farming which is the backbone of the economy of the area.

But Fife is in the modern world now and is suffering many of the problems of pollution, fertilizers, nitrates, etc., affecting rivers, different wetlands and other habitats. The cost of maintaining these areas devolves on various bodies — Scottish Natural Heritage, local authorities with limited budgets, farmers trying to farm according to EU rules, with minimal grants for habitat creation and the problem of making reasonable profits in a now expensive technological industry. Non-governmental organizations, like the Royal Society for the Protection of Birds, and voluntary organizations such as the Wildlife Trusts, all make useful contributions, but there has to be compromise between habitats and economic and population pressures, and often the habitats are lost or degraded.

However, there seems to be a very real drive to protect the environment in Fife. This is being driven by concerned groups including the Farming and Wildlife Advisory Group, Scottish Natural Heritage, the Countryside Commission for Scotland, the River Purification Boards, the Scottish Environmental Protection Agency, and Fife Regional Council. Biodiversity Action Plans are being prepared to help protect ecologically sensitive areas, and areas of environmental interest to the public.

The nature of Fife really opens our eyes to the natural wonders of the county, and the problems brought by constant change, but it will be an excellent investment for the enthusiastic naturalist who ventures forth to explore any or all of Fife's very diverse habitats. It also is an excellent read for anyone interested in general ecology. It ends with a very comprehensive list of all recorded fauna and flora. I thoroughly recommend the book and Fife has become a 'must' in my holiday agenda.

Irene Kettle.

Survey of Bookham Common

FIFTY-SEVENTH YEAR

Progress Report for 1998

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General (Ian Menzies, Chairman, Bookham Common Survey)

Unusually hot sunny weather between January and April with an early spring was interrupted by a cold May and, somewhat unexpectedly, by the wettest summer and autumn experienced for at least ten years. By the end of 1998 conditions at Bookham had recovered from the state of desiccation experienced during recent years, and returned to the marshy conditions that characterized the more distant past, with generation of the best quality mud in Surrey. As mentioned in the reports, rainfall adversely affected much of the field work during 1998, and was largely responsible for the absence of dragonfly and mammal reports this year. The pondlife field day led by Eric Groves on Saturday 13 June was a notable exception: as shown in the photograph (Figure 1) it proceeded with great enthusiasm in spite of heavy afternoon rain! The effect of this very wet period on various aspects of Bookham Common natural history following many years of low rainfall will be a matter of great interest.

As described in greater detail by Ian Swinney in his National Trust management report, grazing by cattle has now been implemented on the whole area of Central, Bayfield and Isle of Wight Plains to help control scrub. This area has been most professionally fenced, with excellent gates to allow easy access and cattle grids on the Isle of Wight Road. Scrub clearance and tree thinning have also continued, but with care to retain sufficient blackthorn scrub for the nightingales which, as described in the bird report by Alan Prowse, are doing particularly well at Bookham. Details concerning vegetation (Ken Page), butterflies and moths (Ken Willmott), beetles, bush-crickets and miscellaneous insects (Ian Menzies), in addition to a list of molluscs found in five of the Bookham ponds provided by Ruth Kirk, are also reported

Management tasks on the Bookham Commons

(Ian Swinney, Warden, The National Trust)

The most important development during 1998 has been the re-introduction of cattle grazing on Bayfield and Isle of Wight Plains after a lapse of nearly fifty years. Heavy rainfall, although beneficial to the wetland areas, prevented the early six-week period of grazing usually begun at the beginning of March to check the early growth of competitive plants and give greater scope for delicate perennials that grow at a slower rate. This is usually followed by an interval to allow flowering and the setting of seed, with resumption of grazing in late summer for as long as the ground conditions, determined mainly by rainfall, permit. A certain amount of treading by cattle is advantageous in creating new sites for plant and invertebrate species, but if excessive the grassland can become dominated by aggressive plants such as thistle and dock.

FIGURE 1. Members studying pondlife with Eric Groves in pouring rain, Bayfield Pond, Bookham Common, 13 August 1998. *Photo: I.S. Menzies*

After consulting our national advisers for nature conservation we considered that the scrub invasion of the grassland areas which arose from lack of grazing and inadequate clearance over many years, and was such that substantial reversal of this backlog would be required to make much impact on plant diversity. It was concluded that re-introduction of grazing livestock should proceed without delay, details concerning timetable and numbers of animals employed to be adjusted as required during succeeding years. Grazing was therefore commenced in May 1998, the animals staying on until the early rains forced us to withdraw them by the second week of October. Eleven Aberdeen Angus cross-breeds were employed to graze the 50-acre (20.8-hectare) site, with the addition of a further seven Light Sussex crosses in September.

The effects of the grazing regime will take time to analyse with the help of botanists from the Society. Initial impressions, bearing in mind the vigorous growth prompted by high rainfall in 1998, are that the cattle have removed a great mass of accumulated rank vegetation, with a favourable impact on vigorous growth at stream margins, together with reduction of saplings and scrub by browsing, and of bracken by trampling.

Grazing by rabbits as well as livestock greatly influences the species composition of scrub. Young trees and shrubs are eaten off and disappear, but thorns can withstand this onslaught and remain recumbent, 'ticking-over' as it were, until grazing pressure lessens as happened following the removal of cattle in 1949, and as a result of the impact of myxomatosis on the rabbit population in the early 1950s. Recent clearance of over-mature scrub, which was as much intended to encourage a regrowth of dense young thorn scrub particularly suitable for nesting birds, as it was to extend the area of open grassland, has been followed instead by invasion with vast numbers of seedling birch and willow, a consequence of their high reproductive capacity and rapid growth. While it may be important to retain some of these birch/willow areas they can all too easily dominate such sites. Re-introduction of grazing solves this problem, birch and willow being browsed off leaving thorns in abeyance, thereby influencing the nature of scrub cover for the next fifty years.

Although loose herding of cattle on common land may still be the custom in parts of the West Country and New Forest, this has largely gone from Surrey where fencing has now become necessary to prevent cattle wandering in a way that was tolerated fifty years ago. A line of scrub clearance was first undertaken in order to establish a fence line around the Central, Bayfield and Isle of Wight Plains, and this has been scalloped where possible to soften the visual impact.

At present we have neither the nearby holding land to accommodate cattle when not grazing on the Common, nor the staff resources needed for maintaining a herd of our own. But the use of stock owned by a local grazier requires a compromise between the grazier's interest in using modern, predominantly grass-eating cross-breed cattle that grow quickly, and our own requirement for slow-maturing rarer breeds that reduce the unpalatable, tough vegetation over more variable grazing periods. Nevertheless the results of the first season of grazing have been very encouraging, and it is hoped to slow down and possibly halt the rapid successional change affecting the grassland areas, and to maintain and increase plant diversity by following the present policy. Scrub clearance has also been continued around Bayfield Pond, and in some areas of the Western and Eastern Plains.

While ensuring an expansion of traditional grassland, The National Trust will continue to manage the plains with a view to encouraging a broad age-range of scrub communities required to support such creatures as the jewel beetle *Agrilus sinuatus* that appreciates a selection of mature hawthorn, and birds such as the nightingale and lesser whitethroat that need sufficient intermediate and young scrub.

The Isle of Wight Pond was showing signs of recovering some of its former ecology since the removal of fish, large patches of pond weed with a corresponding increase of invertebrate life beginning to appear. A setback has occurred with arrival of swans and Canada geese, which have eaten most of the weed, also the appearance of fish fry in large numbers. The latter was not unexpected as many of the common carp were spawning at the time of their removal in 1995. Although this provides food for visiting kingfishers and resident herons, substantial recovery of the pondlife is still awaited.

South Eastern Pond (also referred to as Penny Royal Pond) has been greatly affected by the past drought years, holding very little water and being dominated by flote grass *Glyceria fluitans*. Following recommendations from the LNHS, and Ruth Day in particular, we are proposing a careful restoration of this pond in the near future.

The ancient woodlands of Bookham Common continue to be of great value and interest, but even in this relatively stable environment changes are taking place. An important concern is the increase in oak die-back (or wilt), in which an apparently healthy tree produces progressively less foliage over a number of years and then dies without exhibiting any characteristic younger, epicormic growth from the lower parts of the main branches and trunk. Unfortunately a number of the large mature specimens as well as younger trees appear to be affected. Forestry Authority research is continuing, and at present the condition is thought to be linked to a combination of drought stress, fungal and insect attack, the trees being able to cope with one or even two of these in successive years, but not with a combination of all three factors. There must surely be a maximum capacity for the sustenance of trees on any site, and some will inevitably die following progressive lowering of the water-table, furthermore desiccation may well predispose roots to fungal attack. Certainly at Bookham there appears to be a link with the last ten years of relative drought.

A benefit of tree thinning is increased penetration of heavily wooded areas by sunlight, an important advantage demonstrated by 'wood pasture'. Larger glades and wider rides contribute valuable sites where increased sunlight encourages development of a wider range of ground vegetation and associated fauna in sheltered surroundings. With this in mind widening of the glade at the junction of Woodland and Tunnel Paths, formerly visible on aerial photographs taken in

1944 and 1947, was made the purpose of the project for one of the Trust's Acorn Camp Working Holidays. We were rewarded with the prompt appearance of a white admiral and silver-washed fritillary butterflies within a short period of commencing clearance work.

Future projects in the woodland area include removal of turkey oak *Quercus cerris*, further coppicing of hazel — with careful regard to the dormouse population — widening and edge scalloping of selected paths, and tree thinning on the lower slopes to convert dense woodland to wood pasture.

Again, on behalf of The National Trust, I would like to emphasize our gratitude and appreciation of the valuable work of the LNHS Bookham Common Survey which has helped to make this special place even more interesting and one of the best-recorded sites in the country.

Vegetation: two new plants — native and alien (Ken Page)

After more than fifty years of the Bookham Common Survey it becomes increasingly difficult to find new plants. We were restricted to two in 1998.

Brassica nigra black mustard is generally thought to be native, but was introduced to the Common in fresh soil by workmen installing a cattle grid on the road to Manor Cottage in Division R. *B. nigra* is similar in many ways to *Hirschfeldia incana* hoary mustard, but the two can be separated by the *absence* of seed in the beak of the fruit of black mustard. Hoary mustard, as the name suggests, has a whiter appearance, but confusion can arise without the fruit.

The alien is *Akebia quinata*, a climbing plant from Asia. It has escaped from the Keeper's cottage and is well established on the Common via rooting stems. The plant has fragrant, striking dark chocolate-purple flowers which are monoecious, the female being more conspicuous than the male. As the specific name implies, the leaves are composed of five leaflets. This is the second time it has been found in the wild in our region in recent times. The late Mike Mullin found it very well naturalized in rough ground at Cuddington, where it is clambering through native trees and shrubs.

Footnote. It had been intended to carry out a new major plant survey starting in the year 2002, this date being twenty-five years after the preceding survey and approximately fifty years after the first. However, bearing in mind the advanced age of some members of the team and urgent representations from others, it has been decided that we should start in 1999. Recording has therefore commenced.

Hunting for up to 600 species in twenty divisions, comprising a total ground area exceeding one and a half million square metres is no light undertaking. If any member of the LNHS would like to participate, their help would be greatly appreciated. The survey will certainly extend into the year 2000, and possibly beyond.

Birds (Alan D. Prowse)

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Introduction

The wet start to 1998 continued into the breeding season, and ended with a wet autumn and winter, so the Common returned to a more normal state after several dry years. In the 1997/8 winter the grazing area was extended to Bayfield and Isle of Wight Plains as well as Central Plain, though little grazing was possible in the wet conditions. Considerable clearance was made on Bayfield, with alteration in the birds there. Further major clearances were made in the 1998/9 winter affecting the whole of the plains area. No Common Birds Census (CBC) counts were made in the woodland plot, since Roger Suckling was committed to academic studies. Highlights of the year included thirteen hawfinches in January, and a successful season for the warbler populations.

Summary of the year

A little grebe pair was present on pond 3 from February to June, and a second calling bird was on pond 2 on 12 February. A pair of mute swans from April to June did not nest. Canada geese visited from January to April but did not breed. The overwintering female goosander was last seen on 14 March. Five pairs of mandarin ducks on 10 March were an indication of local numbers but no evidence of breeding was reported. Mallards had many broods, and many of the birds had the abnormal plumage of the hundreds of annually released birds on Effingham fish ponds. Pochard and tufted duck visited in spring but did not breed. In the autumn six mandarin ducks and five teal were maximum counts.

Coots nested on the five main ponds. Moorhens nested on these ponds and on Sheepbell, Kelsey and Bayfield ponds. The first kingfisher for some years was at Isle of Wight Pond on several occasions in December. Herons had twenty successful nests (RS). It is thought that both areas of the heronry had increased disturbance.

A pair of sparrowhawks nested again near the CBC area. Two young were found wet and bedraggled under the nest. They survived at the Leatherhead Wildlife Aid, but their subsequent history is unknown. A male kestrel was present on frequent occasions on Bayfield from January to June, but no female or evidence of breeding were seen. A hobby flew north over the plains on 4 May (RS). A woodcock was flushed on 28 January on Western Plain (ADP). There were no reports of roding or other contacts in the breeding season. Stock doves were once again present near the CBC area, and also nested in SE Wood. Collared doves were in their usual peripheral areas, but were also found at High Point on 8 February. Turtle doves first appeared on 25 April (CP), and five pairs were present in the season, a massive drop from the fourteen pairs in 1997. Cuckoos were present in the woods and on the plains.

Green woodpeckers had six territories on the plains. Great spotted woodpeckers were common. Two territories of the lesser spotted woodpecker were known (CP), with another close to the Common in Little Bookham. House martins nest just off the Common near Bookham Grange Hotel. A count of thirteen nests was made on 10 September.

The first two nightingales sang on 12 April (CP). In mid April the species was heard singing in a snowstorm! There were ten singing males on 29 April, and seven pairs nested (eight in 1997). The species uses blackthorn thicket exclusively on Bookham Common, often over a stream. It no longer nests on Bayfield Plain, and only one pair used Central Plain in 1998. Mature leggy blackthorn is not used, and it is to be hoped that a succession of adequately sized blackthorn thickets can be created on a rotational basis in an area as small as thirty-nine hectares. In 1999 there is a national survey by the British Trust for Ornithology. The Common is of special interest in this survey, both for the habitat used, and for the success in building up numbers on the Common through the mosaic pattern of clearance. Dr Rob Fuller, head of habitat research at the BTO, visited the Common with Andy Wilson in February 1999.

The song thrush maintained its numbers on the plains with ten territories. Mistle thrush numbers may be underestimated since they stop singing early in the season. Singing males are much commoner early in the year, before the main effort starts. For example, three males sang in the CBC area on 21 January, with two others close by. Winter thrushes were scarce in January and February because of the poor autumn crop in 1997. By contrast, the bumper harvest in 1998 gave large numbers of redwings in November and December, and up to thirty fieldfares.

Warblers had a good year. The only grasshopper warblers heard were two singing males on 21 April on Bayfield Plain near dawn (WL). Lesser whitethroats sang on migration in five different areas between 27 April and 4 May, with two songsters on two dates. Other species of warbler are detailed in a later section. Goldcrests were quite common in both winters. Groups of five on 21 January and eight on 17 December were not untypical, usually with mixed flocks of tits. They also occur in small numbers in the breeding season. Long-tailed tits were common throughout the year, and seven pairs had territory on the plains. Marsh tits occur in the woodland, with two pairs in the CBC area, and several elsewhere.

Magpie numbers are quite large in the winter and the breeding season. A roosting flock of about thirty birds gathered each winter on Central Plain. It is reported that a hundred or more roost on an island on nearby Effingham fish ponds. It was reported (Prowse 1998) that starling status was uncertain on the Common. Ron Kettle has since confirmed that the species nested in the CBC area in 1996. In 1998 they are known to have nested in SE Wood and on Western Plain.

Goldfinches were present in three areas of the plains in the breeding season; in the autumn a flock of twenty-six was seen on IoW Plain, and there were other autumn records. In a good winter for siskins, parties were present in January (A&AS) in the woodland and on Central Plain, and up to seventeen redpolls at Sheepbell Pond on 25 January (A&AS). One of the delights of the year was a male siskin in full song on 17 February in the CBC area (ADP, RS). The only record of linnets was of a pair flying near Hundred Pound Bridge on 20 April (ADP). Of the larger finches, there were contacts with bullfinches throughout the year, with ten territories on the plains. Hawfinches were again present on Central Plain in the winter, with maximum count of thirteen on 23 January (ADP). At that date most of the birds were paired, and travelled in pairs rather than as a flock. Reed buntings did not nest this year. Their nesting area on Bayfield Plain had been cleared. Records of a singing male on two occasions (CP, ADP) are the only records for the year. The species nested on the plains when they were grazed in the 1950s (Melhuish 1960), so there is hope they will continue to occur. A yellowhammer was singing near Hundred Pound Bridge on 31 July, the first record for some years.

Willow tits and marsh tits

Willow tits have disappeared from the Common, while the marsh tit remains. Both have had severe declines nationally. My own observations on the willow tit in mature oak wood in Surrey in the 1970s showed that the adults stayed in the winter in the breeding territory (though they do not necessarily do so on Surrey heathland). Marsh tits are also largely resident. One would, therefore, have expected both species to survive on Bookham Common, despite national trends. The willow tit nests in rotten wood while the marsh tit has a more secure nesting hole. Willow tit nests are known to be vulnerable to predation by the grey squirrel *Sciurus carolinensis* and the great spotted woodpecker. The culling of the squirrel on the Common ceased some years ago, and its numbers are high and uncontrolled. The woodpecker is also common with a density in the woodland of nineteen pairs per square kilometre (Prowse 1998). It is possible that the local extinction of the willow tit is related to these two predators. Elsewhere nest boxes have been developed to prevent partially this vulnerability of the willow tit nest site (Maxwell 1999).

Blackcaps and garden warblers

Both species breed commonly on Bookham Common. Edgar, in James (1996), states that garden warblers in Sussex are twice as numerous as blackcaps in woods on clay soil, though the ratio is reversed on other soils in the county. This is not the case on the clay at Bookham. Table 1 shows the range of territory numbers in the CBC area up to 1975 and at the present time. As the canopy closed and the rides narrowed the garden warbler decreased and has now ceased breeding in the woodland. The blackcap has maintained numbers in the woodland, and at a considerably higher density — thirty-seven pairs per square kilometre (Prowse 1998) — than any recorded in Sussex. Both species had similar numbers on the plains in 1997, but the garden warbler was less common than the blackcap in 1998 (Table 2). Their densities on the plains in 1998 were garden warbler forty-nine pairs, and blackcap sixty-nine pairs per square kilometre.

TABLE 1. Number of blackcap and garden warbler territories in the oak woodland CBC area as range over several years.

	1950–4	**1955–60**	**1961–5**	**1966–70**	**1971–5**	**1995–7**
Garden warbler	3 – 7	3 – 7	2 – 4	1	0 – 1	0
Blackcap	2 – 4	2 – 4	3 – 5	1 – 7	2 – 4	3 – 6

TABLE 2. Territories of selected migrants on plains of Bookham Common.

Species	**Territories**			**Change %**	**CES Change***
	1996	**1997**	**1998**	**1997–8**	**1997–8 (adult)**
Turtle dove	present	14	5	−63	
Nightingale	7	8	7	−13	
Whitethroat	26	28	35	+25	−26
Garden warbler	9	14	19	+36	−10
Blackcap	12	12	27	+125	+22
Chiffchaff	8	7	10	+43	+4
Willow warbler	23	36	29	−19	+1

* see text

It is suggested (Cramp et al. 1992) that the two species compete directly against one another. This has always seemed unlikely since the garden warbler returns in summer several weeks later than the blackcap, which would put it at a considerable biological disadvantage. Maps of their distribution on the Common differ, but there are some areas which they share. In the shared areas, e.g., along the margins of the main ponds, they have song posts within feet of each other, without aggression, or response to the other's song, neither do they respond to the other's recorded song. There seems, therefore, to be little basis for the statement that they are direct competitors, though the blackcap is known to be aggressive on occasions to other species both in winter and the breeding season.

Selected migrants

Table 2 shows figures for 1996–8 for some migrants, and the percentage change between 1997 and 1998. Turtle dove, nightingale, whitethroat, garden warbler and willow warbler are all trans-Saharan migrants. Blackcaps and chiffchaffs winter in southern Europe though some British chiffchaffs cross the Sahara to Senegal. The Bookham Common turtle dove population crashed in 1998, though the nightingale population fell little from its maximum figure the previous year.

The BTO operates a Constant Effort Sites (CES) ringing scheme. The results closely follow the CBC results nationally, and the preliminary CES results for 1998 have already been published (Balmer and Wernham 1999). As an indication of national population change the CES results for 1997–8 are included in Table 2. The Bookham Common whitethroat and garden warbler numbers were much increased despite a national fall. The clearance of much of Bayfield Plain lowered the willow warbler numbers, probably temporarily, from the previous high totals. Blackcap numbers increased markedly on the plains, more than the national figure.

It is noticeable that the trans-Saharan migrants fared less well than the others. It has been claimed that the periodic sub-Saharan droughts in the Sahel are a consequence of the El Niño weather phenomenon, which was particularly severe in 1997. Sahel droughts reduced the British populations of the whitethroat by 75 per cent progressively from 1969 to 1974 (Winstanley et al. 1974, Batten and Marchant 1977), so the numbers of our migrants will be watched with interest in the next few years.

Common Birds Census

The CBC plot of oak woodland has been studied for approximately fifty years. In 1998 it was not possible to record a census here since Roger Suckling had other commitments. The census involves at least ten visits of four hours each through the breeding season, plus a large amount of time transferring the data to species maps. The CBC will be eventually superseded nationally by the Breeding Bird Survey (BBS), which covers a greater range of unselected areas, and is as reliable in the assessment of national trends as the CBC. The time involved in the 16.2 hectares of our CBC area per annum would cover ten square kilometres in the BBS.

The archive has produced two papers of note in the last two years. The first (Newton et al. 1997) relied on the survey pre-dating the BTO's CBC, enabling the sparrowhawk to be studied for ten years before DDT, during DDT, and for ten years after. The second paper (Newton et al. 1998) used a limited part of the archive to demonstrate density-dependent population growth because the survey had been counted by one observer only, namely Geoffrey Beven. It is difficult to envisage that an observer will give up the whole of each breeding season to plot the very limited range of species in mature and post-mature oak woodland, merely adding another year's statistics to an archive which has not been summarized since 1976, and which deals poorly with such species as owls, ducks, woodcock, and hawfinch, all of which have recently been present. This type of woodland is studied in great detail elsewhere, e.g., Wytham Wood in Oxfordshire. I am, therefore, pessimistic regarding the reinstatement of the CBC on the Common, though I hope for periodic surveys.

Predation and disturbance

Restriction of dogs in many places results in increasing numbers on the Common. A recent newsletter of the Friends of Bookham Common details the number of roe deer savaged by these dogs in a recent month. People throw sticks for their dogs into ponds where there are broods of small ducklings. Mention has already been made of the large numbers of grey squirrels and magpies. The increasing public pressure on the Common has resulted in more paths in previously quiet areas, and greater disturbance of the heronry.

Acknowledgements

My thanks are due to those observers who submitted records during the year: P. Crook, R. Kettle, C. Pettigrew, Anna and Andrew Stribley, Roger Suckling, Ian Swinney, and Dr W. Landells.

References

BALMER, D. and WERNHAM, C. 1999. Many long-term declines continue on Constant Effort Sites, *BTO News* **221**: 10–11.

BATTEN, L.A. and MARCHANT, J.H. 1977. Bird population changes for the years 1974–75. *Bird Study* **24**: 55–61.

CRAMP, S. et al. (eds) 1992. *The birds of the western Palearctic* **6**. Oxford University Press.

JAMES, P. (ed.). 1996. *Birds of Sussex*. Sussex Ornithological Society.

MAXWELL, J. 1999. "Pure dead brilliant box, Jimmy". *BTO News* **221**: 12–13.

MELHUISH, W.D. 1960. Recent changes in the bird population of grassland with encroaching scrub at Bookham Common. *Lond. Nat.* **39**: 89–98.

NEWTON, I., DALE, D. and ROTHERY, P. 1997. Apparent lack of impact of sparrowhawks on the breeding densities of some woodland songbirds. *Bird Study* **44**: 129–135.

NEWTON, I., DALE, D. and ROTHERY, P. 1998. Density-dependence in the bird population of an ancient oak wood over 22 years. *Ibis* **140**: 131–136.

PROWSE, A.D. 1998. Birds of Bookham Common in the breeding season. *Lond. Nat.* **77**: 177–187.

WINSTANLEY, D., SPENCER, R. and WILLIAMSON, K. 1974. Where have all the whitethroats gone? *Bird Study* **21**: 1–14.

Butterflies and moths (Ken Willmott)

An unusually warm and sunny 10 January tempted out a comma *Polygonia c-album* in The Glade during the morning, where it obligingly settled on a dead hazel stick to be photographed by Ian Menzies (Figure 2). No other butterflies were seen that day, and it was not until the remarkably high temperatures of mid February (61°F/17°C on the 13th) that a notable flurry of early interest occurred. Then, the first species to be seen, rather unusually, was the red admiral *Vanessa atalanta*, obviously a winter 1997/8 survivor. This particular specimen was observed on the same 'territory' at the northern end of The Broadway for over a month. Eight or more male brimstones *Gonepteryx rhamni* and a similar number of commas were seen, also on the warmest day of February.

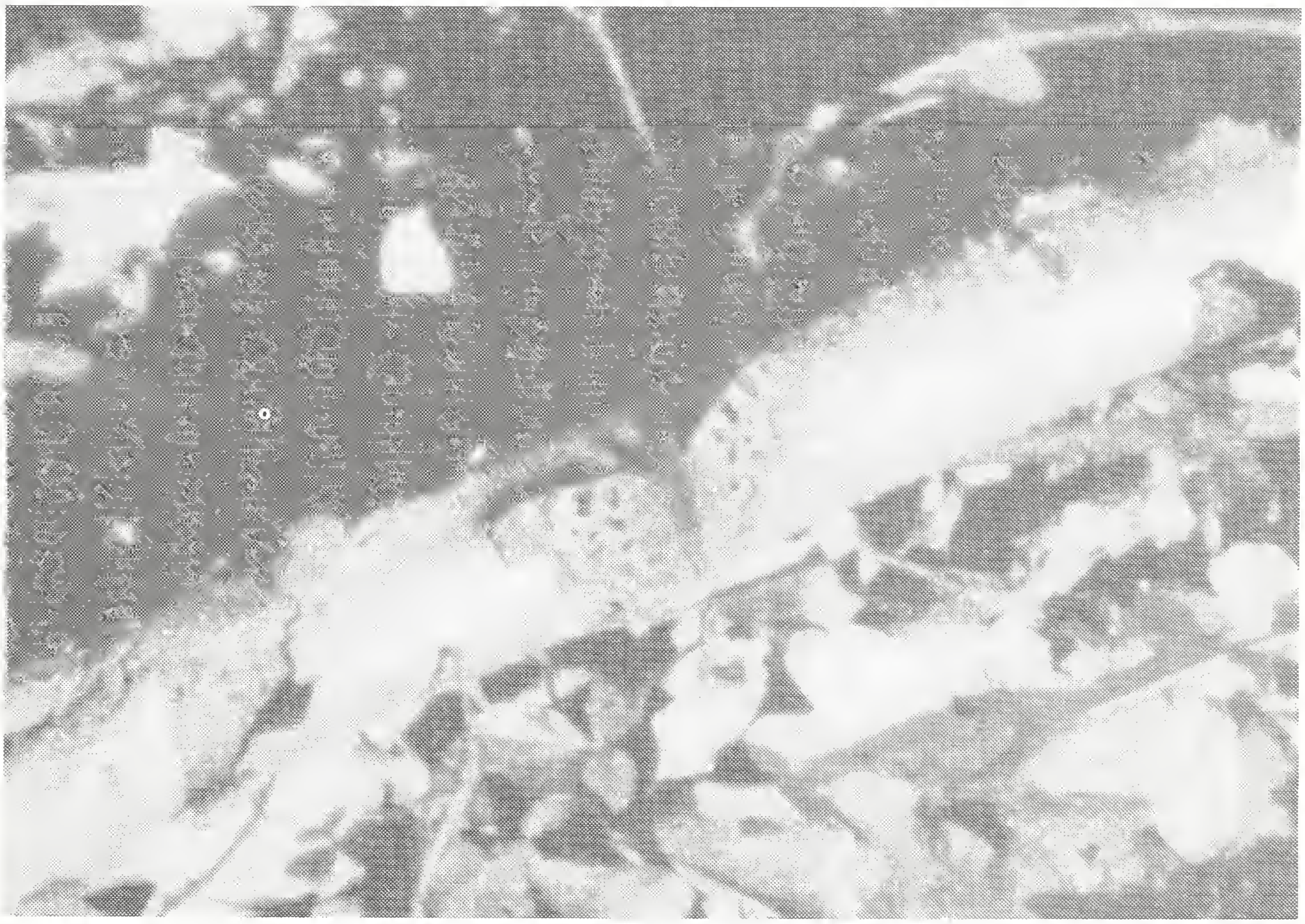

FIGURE 2. Comma butterfly, The Glade, Bookham Common, 10 January 1998.
Photo: I.S. Menzies

March was a less exceptional month, with only nine days when temperatures were above the 55°F/13°C mark, five of these during the last week. This heralded a rather disappointing spring, with the exception of a fine spell in mid May which gave some good opportunities for several of the early species to locate mates and deposit their eggs.

The first speckled wood *Pararge aegeria* was seen on 20 March. The Broadway is a particularly good woodland ride for this species, but indicates how shady it has become in places, and in need of attention in order to attract and maintain many of the other interesting species on the Common. Several 'crowded' oak trees, *Quercus* sp., marked for felling in order to improve the sunlight penetration, have yet to be dealt with. Shady areas for speckled wood and white admiral *Ladoga camilla* will be retained in places in order to provide species diversity along The Broadway. Two orange underwings *Archiearis parthenias* were observed down on the ground at a muddy patch. There are fine birches *Betula* sp. along The Broadway in remnant sunny clearings, upon which the summer larvae probably feed.

April, particularly the middle part, was a cold month in general, with frost and some wet snow, although on 22 April the first 70°F/21°C of the year was recorded, sandwiched in between two poor days. The first orange-tip *Anthocharis cardamines* was seen in my Leatherhead garden on 12 April. On the same day a grey shoulder knot *Lithophane ornitopus lactipennis* was found at rest on a horse barrier along The Broadway. On 25 April, a sunny afternoon followed morning rain and the pierids, or whites, were on the wing. These were small white *Pieris rapae*, green-veined white *Pieris napi* and half a dozen orange-tips. Approximately twenty small tortoiseshells *Aglais urticae* were active around various beds of stinging nettles *Urtica dioica* and peacocks *Inachis io* were indulging in the later stages of their courtship. There were a dozen or more speckled woods at various locations on the Common.

The warm spell in May brought some interesting immigrant species to Bookham Common. On 9 May a painted lady *Vanessa cardui* was seen at Merritt's Cottage (Ian Menzies) and the next day I observed a female of the same species busily depositing eggs, late in the day (17.20hrs), mainly on creeping thistle *Cirsium arvense.* A silver Y *Autographa gamma* was also seen on the same day flying in the vicinity of the painted lady egg-laying site. The holly blue *Celastrina argiolus* was also seen on the Common at this time (Ron Kettle). The small immigration of insects from the Continent also produced some red admirals, one of which established a territory in the road outside my Leatherhead house on 14 May.

Late in the month a half-grown larva of the silver-washed fritillary *Argynnis paphia* was located by Ian Menzies eating violets *Viola* sp. growing amongst grass in the shade alongside Glade Path. This must be the first time a wild larva has been found on Bookham Common for many years and must be a direct result of the recent expansion in its range and resulting increased numbers in Surrey. This has been a particularly noteworthy event on the Common since July 1996.

June was a poor month, with limited sunshine and higher than average rainfall, particularly the latter part of the month. The large skipper *Ochlodes venata* was seen in very small numbers on 20 June, together with a fresh comma. Two larval batches of the peacock were also found on the nettles on this date. No white-letter hairstreaks *Strymonidia w-album* were seen on 27 June and I surveyed 150 metres of their elm *Ulmus* sp. habitat on Banks Common and this yielded some interesting results. Of one hundred and forty-five trees assessed, of various trunk girths, twenty-one were completely dead through Dutch elm disease and sixteen were in various stages of the disease. Therefore some 25 per cent of the elm trees utilized by white-letter hairstreaks were affected. The story is similar wherever there is elm on the Common. A female red admiral was seen depositing eggs on the nettles on 27 June and ringlets *Aphantopus hyperantus* were just making an appearance, with some half dozen being seen.

The silver-washed fritillary, with the larval stage only half grown on 30 May, suggested a late emergence on the Common in 1998 and this was certainly the case, due to the generally poor spring weather. On 3 July the white admirals were seen, but no silver-washed fritillaries (Ian Menzies). On 5 July over fifty white admirals were observed, but once again no silver-washed fritillaries which were unusually late in appearance. On this date however, half a dozen purple emperors *Apatura iris* were seen, ncluding two different male specimens on road surfaces late in the day (16.00 hrs and 17.00 hrs). This is typical of male activity during the unsettled weather conditions which prevailed in July 1998. Temperatures only reached 70°F/21°C on twelve days and the highest was 76°F/24.5°C on 20 July, this producing afternoon thunderstorms.

Only half a dozen white-letter hairstreaks were seen on 5 July, but over fifty ringlets and a single purple hairstreak *Quercusia quercus*. The small skipper *Thymelicus sylvestris* was another victim of the weather, late on the wing and reduced in numbers. The meadow brown *Maniola jurtina* was well out on 5 July, but one of its most prolific habitats on Banks Common was being cut for hay. The timing of this event can be critical and to benefit this mainly grassland species (smaller numbers along woodland rides on the Common) the hay should be cut when a good percentage of the females have emerged. During the cutting operations the meadow browns disperse to the rough and flowery field edges and after the cut the females readily return, to deposit eggs amongst the remaining 'stubble'.

On 19 July over a dozen silver-washed fritillaries were seen (at last!) including three females, one being engaged by a persistent 'circling' courting male. The gatekeeper *Pyronia tithonus* was just beginning to appear and there were small numbers of small skippers, one Essex skipper *Thymelicus lineola*, a 'new' brimstone and two white-letter hairstreaks.

The silver-washed fritillary was noted as 'abundant' on the Common on 23 July and still frequent, although rather worn by 11 August (Ian Menzies). Approximately a dozen six-spot burnets *Zygaena filpendulae stephensi* were found on the wing on 19 July and during the same day I located, for the first time in my experience, the early stages of the day-flying sessiid moth the large red-belted clearwing *Synanthedon culiciformis* on some birch stumps near Merritt's Cottage. Once again the vagaries of the British climate have made life difficult for the multitude of Lepidoptera on Bookham Common during 1998, but one remains optimistic for their survival in 1999.

Beetles (Ian Menzies)

Longicorn beetles (Cerambycidae), usually found by beating hawthorn blossom during May, were disappointingly scarce in 1998 as they also were in 1997. *Anaglyptus mysticus* (3), *Grammoptera ruficornis* (3) and single examples of *Rhagium mordax* and *R. bifasciatum* were seen on 9 May, and on 17 May *A. mysticus* (3), *G. ruficornis* (4), *R. mordax* (4) and *Alosterna tabacicolor* (2) were noted, while only a single 'wasp beetle', *Clytus arietis,* usually abundant, was seen on 30 May. However, a further specimen of the rare *Grammoptera variegata* (Germar), recorded from the Common on about three previous occasions only, was obtained by beating the hawthorn blossom by Glade Path on 15 May. On the same day *Judolia cerambyciformis,* a species recently added to the Bookham Common list, was found on the Merritt's Cottage gate! The handsome buff-coloured beetle with black speckling, *Saperda populnea,* larvae of which produce conspicuous swellings on the smaller stems of aspen, was seen at rest on an aspen leaf in The Glade on 30 May. Several adult *Phymatodes testaceus* awaiting emergence were discovered under loose bark on oak logs in the aboretum on 30 May and 1 June. The latter two species of longicorn beetle are not attracted to flowers.

Leaf beetles (Chrysomelidae) of interest seen during 1998 include the spectacular green *Chrysolina menthastri,* eight of which could still be counted on the leaves of water mint by Lower Eastern Pond as late as 10 October, and the copper-coloured *Chrysolina brunsvicensis* from *Hypericum tetrapterum* on Western Plain on the same date. *Lilioceris lilii* (Scopoli), the bright orange lily beetle — only too well known to gardeners — and *Nephus quadrimaculatus* (Herbst), a tiny black ladybird with four red elytral spots, both apparently new to Bookham Common, were discovered by Maxwell Barclay when sweeping vegetation at the side of Common Road on 1 May. A further specimen of *N. quadrimaculatus* was beaten from ivy in the same area on 1 June (I.S.M.): although this beetle is regarded as a 'vulnerable' species (status RD2) it appears to be spreading and has been noted from several other parts of Surrey during 1998. Maxwell Barclay also reports finding six specimens of *Aphodius conspurcatus* (Linnaeus), a notable dung beetle, in horse manure by the road to White House on the west side of Bayfield Plain on 14 November. Single specimens of *Uleiota planata* (Linnaeus), a flat bark beetle (Cucujidae) recorded for the first time on Bookham Common last year (M.B.), were found on three further occasions this year, 30 May, 1 June and 8 August, under the loose bark of oak logs in the arboretum (I.S.M.).

Bush-crickets and miscellaneous insects (Ian Menzies)

The persistent cold weather during May seems to have exerted far more influence on the development of bush-cricket nymphs than the hot sunny conditions and early spring weather in March and April. Few species attained maturity during July and even by the middle of August a large proportion of most species were still immature.

However, by the time of the Bookham Common bush-cricket field day on 8 August Roesel's bush-cricket *Metrioptera roeselii* was stridulating in some numbers on the Bayfield Plain, and both nymph and adult long-winged coneheads *Conocephalus discolor* were evidently very numerous in most of the grassy areas and could be discovered without difficulty. A practical problem with Roesel's bush-cricket was its loud persistent stridulation, likened to the sound of a miniature circular saw, which drowned those of other species so that they became difficult to identify even with the assistance of a bat-detector. Only single examples of the usually plentiful oak and speckled bush-crickets *Meconema thalassina* and *Leptophyes punctatissima* could be found (due to delayed maturity?), but the presence of a colony of the dark bush cricket *Pholidoptera griseoaptera,* advertised by a characteristic 'tss . . tss . . tss . . tss' stridulation issuing from vegetation at the scrub border of an open grassy area, was located on the Western Plain. In the same area the handsome 'common green grasshopper' *Omocestus viridulus* was present. This grasshopper, which is certainly not the only green British species, and, as at Bookham, often rather scarce, also has a distinctive stridulation — in this case rather like the sound of a diminutive single-cylinder pumping engine. The so-called 'meadow grasshopper' *Chorthippus parallelus,* also usually green, was found in much larger numbers in most of the grassy areas. On 10 October the long-winged conehead was still stridulating, although not very vigorously, on the Western Plain.

The short-winged conehead *Conocephalus dorsalis* could not be detected during 1998, even in the last remaining site on Western Plain. Reduction of this species at Bookham during the last few years is not an isolated phenomenon, as it has also retreated from dry grassy sites on Epsom Common, although still to be found amongst marsh vegetation (*Juncus* etc.) along the side of Great Pond (September 1998). Could this be a response of the short-winged conehead, which is known to favour a more marshy environment than the long-winged conehead, to a series of unusually hot dry summers? Alternatively, in view of the extraordinary spread and increased incidence of the long-winged species on dry grassy areas in Surrey during recent years, might this be an example of competitive exclusion? The effect of the unusually wet weather of 1998 and early 1999 on the incidence of these two species may help to answer this question.

A further example of the effect of the cold wet summer has been delayed development of the box bug *Gonocerus acuteangulatus.* Although this species has spread to many new areas in Surrey (for instance in Nonsuch Park and at Surbiton and Molesey) during 1998, nymphs persisted throughout August, indeed the adult stage was not seen at Bookham until 12 October!

On 11 August a worker hornet *Vespa crabro* was seen in the Isle of Wight Plain (I.S.M.). The hornet is rare in Surrey, an exception being Richmond Park where it is seen quite regularly, nests being sited in the hollow branches of old oak trees and disused woodpecker holes.

Molluscs from five Bookham ponds (Ruth Kirk)

The following molluscs were identified during surveys of the Bookham ponds in 1997 and 1998. My thanks to Dr Michael Kerney of The Natural History Museum, London for checking the identification of some very small *Lymnaea palustris.*

Key: Isle of Wight Pond (IoW), Western Hollow Pond (WHP), Eastern Hollow Pond (EHP), Lower Eastern Pond (LEP), Upper Eastern Pond (UEP).

	IoW	**WHP**	**EHP**	**LEP**	**UEP**
Acroloxus lacustris (L.) lake limpet		×	×	×	
Armiger crista (L.) nautilus ramshorn			×	×	
Anisus vortex (L.) whirlpool ramshorn		×	×	×	×
Gyraulus albus (Müller) white ramshorn		×	×	×	×
Hippeutis complanatus (L.) flat ramshorn		×			
Lymnaea auricularia (L.) ear pond snail	×	×			
Lymnaea palustris (Müller) marsh snail	×	×	×	×	×
Lymnaea peregra (Müller) wandering snail			×	×	×
Lymnaea stagnalis (L.) great pond snail		×	×	×	
Physa fontinalis (L.) bladder snail	×	×	×	×	×
Physa acuta Drap. pointed bladder snail	×	×	×		
Pisidium sp. pea mussel	×	×			
Planorbarius corneus (L.) great ramshorn				×	
Planorbis planorbis (L.) ramshorn snail		×		×	
Sphaerium sp. lake orb mussel	×	×	×	×	×

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Book review

Flora of County Dublin. The Dublin Naturalists' Field Club: compiled and edited by Declan Doogue, David Nash, John Parnell, Sylvia Reynolds and Peter Wyse Jackson. 1998. 558 pp., 18 colour plates, 6 black-and-white plates, large colour map of Co. Dublin. Hardback, ISBN 0 9530037 0 1, £25; special limited edition, quarter-bound in leather with slipcase, of 100 numbered copies with frontispiece of *Scilla verna* spring squill by Wendy Walsh, ISBN 0 9530037 1 X, £150. Both prices Irish or sterling.

The highest praise for this work is that it matches the quality of Colgan's original *Flora*, published in 1904. I learnt my botany in Dublin and lived for school and university years in north County Dublin — this flora brings back many happy memories of learning my plants, discovering the works of Robert Lloyd Praeger and battling with the translucent keys in Webb's *Flora*. Much was made clearer after several pints of Guinness in Kenny's of Westland Row, a traditional meeting place of Dublin's botanists and zoologists. I remember the joy of learning that you could still obtain original copies of *Irish Topographical Botany* for a very reasonable sum from the Royal Irish Academy and a good reprint of *The Way That I Went* was available in Eason's of O'Connell Street. Colgan's *Flora* was more difficult to track down in 1970's Dublin, the few copies for sale were locked in fine glass bookshelves in antiquarian bookshops priced well above a student's means. Fortunately, college and friends' copies could be photocopied and this well-thumbed text is still in my possession. My respect for the greats of Irish Botany — Praeger, Brunker, Stelfox and Colgan increased when I worked with Tom Curtis in the 1980s hunting to refind their many records of rare flora when we were compiling the *Red Data Book*.

This work is collegiate, the result of ten years' work by members of the Dublin Naturalists' Field Club. Part one covers the topography, climate, geology and soils and historical background. Part II is the systematic section giving distribution, frequency and habitat information on over 1,300 species. Distribution maps are included for 200 species and the text includes an extensive bibliography and topographical index. A section of fine ink drawings by Wendy Walsh of some Dublin plants add an extra dimension — one could only wish for more than the six plates included. The colour plates of habitats are a little lacklustre and the work calls out for some visual representation of the expansion of urban and suburban Dublin. These are minor quibbles with a major Irish *Flora* which will be an important reference text for conservation within the county. Dublin once again is undergoing an economic boom with business and housing developments, new roads, quarries, municipal dumps and golf courses eating into the character of the landscape. It is vital that this work and the data it is based on are accessible to planners and government advisors and that change is continually monitored. The members of the Dublin Naturalists' Field Club have a vital role to play in policing the impact of such development. The use of this book to empower local communities and schools about the history and importance of their plants is also to be encouraged. Local community action plans could also be developed. I look forward to its impact.

NOEL McGOUGH
Conventions & Policy Section, RBG Kew

Hampstead Heath Survey

Progress Report for 1998

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General (C. Bowlt, Chairman)

The Survey will be three years old in July 1999. The effort put in by the members and the results obtained in this comparatively short time have been very satisfactory. The Heath is an open space under huge public pressure, from walkers, dogs, sporting activities and so on, and yet where wildlife strives to find a home with varying success. In that sense the Heath is one big experiment. If our Survey can only ask the right questions to guide our recording it is to be hoped that our long-term findings will be of use in managing not only the Heath but also the increasing number of pressurized public open spaces elsewhere.

An open day for the LNHS was held in May 1998, to show the rest of the Society what we get up to. Some of the results of what we do are given in the reports which follow. My many thanks to everyone who helped, in particular with the mole survey. I hope they all found it fun and as interesting as I did.

Vegetation: birdseed and other non-native species (Barbara Villiers)

During the past year much interest has been focused on birdseed and other casual introduced species which add considerably to the diversity of the Heath's flora. It is, of course, well known that many visitors regularly feed the birds so it can be assumed that a number of the unfamiliar plants come from scattered birdseed.

A small drainage gutter — popularly known as the 'gully' — alongside a footpath leading from Gospel Oak Station past The Lido and the Corporation of London's Information Centre to Parliament Hill Fields is particularly productive (TQ 282858). This gully is cleared from time to time, which makes one speculate on what effect it may have on the plant community. Does clearance possibly provide favourable conditions for some of the non-native species which might otherwise be crowded out by native grasses, etc?

Last summer some of the finds were new or recent records for the Heath. (Fuller details are held on the Heath Survey's computer). These include *Amaranthus retroflexus* common amaranth, *A. alba* white pigweed, *Fagopyrum esculentum* buckwheat, *Lepidium sativum* garden cress which is a frequent casual, *Linum usitatissimum* flax which, according to D.H. Kent, was first recorded in Middlesex in 1638 by Thomas Johnson (Kent 1975: 228); *Medicago sativa* ssp. *sativa* lucerne which has increased in frequency in Middlesex since 1869 (Kent 1975: 86); and *Raphanus sativus* garden radish. Very small specimens of *Anoda cristata* spurred anoda, family Malvaceae, a rare casual from south-east North America (Stace 1997: 211), and *Salvia reflexa* mintweed from North America (Stace 1997: 577–578) were found by Margo Nagle. These are both new records for the Heath but George Hounsome, who identified them and obtained confirmation from Eric Clement, writes 'Both are illustrated in past editions of *BSBI News* as referenced in *Alien plants of the British Isles*' (Clement and Foster 1994: 80, 264), where they are listed as having been recorded in several localities. One plant of *Abutilon theophrasti* velvetleaf was seen by the gully in 1998. *Rumex cristatus* Greek dock, reported by Johnnie Slattery and determined by Geoffrey Kitchener, also appeared in the Bird Sanctuary near Highgate Ponds.

We have records for *Datura stramonium* thorn-apple on the railway embankment at Gospel Oak in 1996 and in the gully in 1998. A previous record was Hampstead Heath railway station in 1941 (Kent 1975: 400).

Guizotia abyssinica niger, family Asteraceae from East Africa, was seen growing opposite a small café on Parliament Hill Fields. It has been found in a number of localities in the British Isles (Clement and Foster 1994: 353), but this is surely the first record for the Heath?

Finally, mention should perhaps be made of some of the introduced grasses recently recorded both in the gully and near the so-called Bird Bridge, near the Viaduct Pond on East Heath which, needless to say, is another popular site where visitors feed the birds. The fairly common *Avena sativa* oat and the long-awned *Echinochloa crus-galli* cockspur from the Tropics have been found in both the above localities. The latter was also recorded on the Gospel Oak railway embankment in 1996. *Panicum miliaceum* common millet, *Phalaris canariensis* canary-grass and *Sorghum halepense* Johnson-grass have all been seen at various times in and by the gully.

Acknowledgements

My thanks to George Hounsome, Margo Nagle and Johnnie Slattery for valuable assistance in identification and recording.

References

CLEMENT, E.J. and FOSTER, M.C. 1994. *Alien plants of the British Isles.* Botanical Society of the British Isles, London.

KENT, D.H. 1975. *The historical flora of Middlesex.* The Ray Society, London.

STACE, C. 1997. *New flora of the British Isles.* Ed. 2. Cambridge University Press.

Fungi (Colin Bowlt)

The LNHS Survey has not so far carried out any systematic searching for fungi, but it is felt worthwhile to list those that have been recorded in the last few years to act as a stimulus to further work and as an initial checklist. They are largely limited to the 'macro' fungi, that is the mushrooms and toadstools, but the number of species found to date is expected to be a small fraction of those that occur on the Heath. The difficulty is that the 'fruit bodies' of fungi are notoriously erratic in their appearance, and it will require several years of assiduous searching before a true picture of the fungi species is obtained. An area the size of the Heath with its wide range of geology and habitats is expected ultimately to produce a list of several hundred 'macro' fungi, and even more 'micro' fungi.

Determinations of the recorders have been accepted throughout. Identification of many species is difficult. Some of the records may be erroneous with no voucher material to enable verification. This should always be considered in the interpretation of such lists.

The list is presented in alphabetic sequence within the major divisions of fungi classification. The Survey is grateful to all those who have contributed records: their names are listed under abbreviations.

Abbreviations

CB	Colin Bowlt	MN	Margot Nagle
CD	Clifford Davey	RP	Richard Payne
PH	Peter Holland		

H	Heath (areas not specified)	**A6**	Priors Field and East Heath
A1	Parliament Hill Fields	**A7**	West Heath
A2	South Meadow	**A8**	Sandy Heath
A3	Cohens Fields	**A9**	Heath extension
A4	Kenwood	**A10**	Golders Hill Park
A5	Vale of Health and East Heath		

BASIDIOMYCOTA

Agaricus arvensis: **A2** October 1998 MN,

Agaricus bisporus: **H** October 1996 CD; **H** September 1997 RP.

Agaricus campestris: **A5** October 1997 RP; **A9** June 1997, June 1998 CB.

Agaricus langei: **A9** September 1998 CB.

Agaricus silvaticus: **A8** September 1997 CB.

Agaricus xanthoderma: **H** October 1995 CD; **A9** September 1997 MN; **A9** September 1998 MN.

Amanita citrina: **H** October 1994 CD.

Amanita fulva: **A8** June 1997; **A4** August 1997 MN.

Amanita muscaria: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A5** October 1997 RP; **A9** October 1998 MN.

Amanita rubescens: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **A8** June 1997 CB; **A4** August 1997 MN; **A5** October 1997 RP.

Amanita spissa: **A8** August 1996 CB.

Armillaria mellea: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A5** October 1997 RP.

Armillaria tabescens: **A5** October 1997 RP.

Auricularia auricula-judae: **H** January 1987 PH; **H** October 1996 CD; **A8** September 1997 CB; **A9** June 1997 CB; **A1** September 1998 MN; **A2** October 1998 MN; **A4** November 1998 CB.

Auricularia mesenterica: **H** January 1987 PH; **A1** September 1998 MN.

Bjerkandera adusta: **H** January 1987 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Bolbitius vitellinus: **H** October 1996 CD; **A9** May 1997 MN, June 1997 CB.

Boletus albidus: **H** September 1997 RP.

Boletus badius: **H** September 1997 RP; **H** October 1989 PH.

Boletus chrysenteron: **H** October 1994 CD; **H** October 1995 CD; **A9** August 1996 CB; **H** October 1996 CD; **A9** September 1998 CB, October 1998 MN.

Botetus edulis: **H** September 1997 RP.

Boletus erythropus: **H** September 1997 RP.

Boletus parasiticus: **A8** September 1997 CB.

Boletus porosporus: **H** October 1995 CD; **A9** September 1997 MN.

Calocera cornea: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Calocera glossoides: **H** January 1987 PH.

Chondrostereum purpureum: **H** January 1987 PH; **H** October 1989 PH; **A7** November 1998 CB.

Clavulina cristata: **H** October 1994 CD.

Clitocybe clavipes: **H** October 1997 RP.

Clitocybe flaccida: **A1** November 1998 CB.

Clitocybe geotropa: **A9** October 1998 MN.

Clitocybe infundibuliformis: **A5** October 1997 RP.

Clitocybe nebularis: **H** October 1994 CD; **H** October 1995 CD; **A5** October 1997 RP; **A8** November 1997 CB; **A6** November 1998 CB; **A8** November 1998 CB.

Clitocybe odora: **H** October 1997 RP.

Collybia butyracea: **H** January 1987 PH; **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A8** November 1997 CB; **A9** October 1998 MN; **A1** November 1998 CB.

Collybia confluens: **H** October 1995 CD; **H** October 1997 RP.

Collybia dryophila: **H** October 1995 CD; **H** October 1996 CD; **A5** October 1997 RP; **A9** October 1998 MN.

Coniophora puteana: **H** October 1994 CD; **H** October 1995 CD.

Conocybe lactea: **H** October 1996 CD.

Conocybe tenera: **H** October 1996 CD; **A1** September 1998 MN.

Coprinus atramentarius: **H** October 1996 CD; **H** October 1997 RP.

Coprinus comatus: **H** October 1994 CD; **A5** October 1997 RP.

Coprinus lagopus: **H** October 1994 CD; **H** October 1996 CD; **A9** September 1997 MN.

Coprinus micaceus: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A8, A9** March 1997 CB.

Coprinus plicatilis: **H** October 1996 CD; **A1** September 1997 MN; **A9** October 1998 MN.

Cortinarius decipiens: **H** October 1994 CD.

Coriolus versicolor: **H** January 1987 PH; **H** September 1990 PH; **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A7** March 1997, **A5** October 1997 RP; **A8** September 1997 CB; **A9** October 1998 MN.

Crepidotus variabilis: **H** January 1987 PH; **H** October 1994 CD; **A9** October 1998 MN.

Daedaleopsis confragosa: **H** January 1987 PH; **H** October 1994 CD; **A8** September 1997 CB; **A8** November 1998 MN.

Dacrymyces stillatus: **H** January 1987 PH; **A7** November 1991 PH; **A9** October 1998 MN.

Exidia glandulosa: **A5** January 1998 CB; **A8** September 1998 CB.

Fistulina hepatica: **H** September 1990 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A9** September 1997 CB; **A5** October 1997 RP; **A9** September 1998 CB.

Flammulina velutipes: **H** January 1987 PH; **A9** December 1997 MN; **A8** January 1999 MN.

Galerina hypnorum: **H** January 1987 PH.

Galerina marginata: **H** October 1996 CD.

Galerina praticola: **A5** October 1997 RP.

Ganoderma adspersum: **H** September 1990 PH; **H** October 1994 CD; **H** October 1995 CD; **A9** September 1997 CB; **A5** October 1997 RP; **A6** September 1998 MN; **A8** August 1998 CB; **A9** September 1998 CB.

Ganoderma lucidum: **A9** September 1997 CB.

Ganoderma resinaceum: **H** October 1994 CD.

Geastrum triplex: **A4** March 1999 MN.

Grifola frondosa: **A5** October 1997 RP.

Gymnopilus junonius: **H** October 1994 CD; **H** October 1995 CD; **A5** October 1997 RP; **A1** September 1998 MN; **A9** October 1998 MN.

Hebeloma crustuliniforme: **H** October 1994 CD; **H** October 1995 CD.

Hebeloma sacchariolens: **H** October 1989 PH; **H** October 1994 CD.

Hygrocybe conica: **A7** November 1991 PH.

Hygrophoropsis aurantiaca: **H** October 1995 CD.

Hypholoma fasciculare: **H** January 1987 PH; **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A5** October 1997 RP; **A8** November 1997 CB; **A9** October 1998 MN; **A1** November 1998 CB.

Inocybe geophylla: **H** October 1994 CD.

Inocybe pusio: **H** October 1996 CD.

Inocybe rimosa: **H** October 1994 CD.

Inonotus hispidus: **H** October 1994 CD; **A5** October 1997 RP.

Inonotus radiatus: **H** January 1987 PH.

Laccaria amethystea: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Laccaria laccata: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A1** September 1998 MN.

Lacrymaria velutina: **H** September 1990 PH; **H** October 1996 CD; **A4** May 1997, **A8** June 1997 CB.

Lactarius glyciosmus: **H** October 1989 PH.

Lactarius quietus: **H** October 1994 CD; **H** October 1995 CD.

Lactarius turpis: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1996 CD; **A5** October 1997 RP; **A9** October 1997 and October 1998 MN.

Lactarius vellereus: **H** September 1997 RP.

Laetiporus sulphureus: **A9** May 1997, July 1998 CB.

Leccinum scabrum: **A5** October 1997 RP; **A7** September 1998 MN.

Leptista nuda: **A7** November 1991 PH; **A9** October 1998 MN.

Lycoperdon foetidum: **H** October 1994 CD; **H** October 1995 CD.

Lycoperdon perlatum: **H** October 1996 CD; **H** September 1997 RP; **A9** September 1998 CB.

Lycoperdon pyriforme: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD.

Lyophyllum decastes: **H** October 1994 CD.

Macrolepiota procera: **H** October 1994 CD; **A9** October 1997 MN.

Macrolepiota rhacodes: **A1** September 1998 MN.

Marasmius graminum: **A4** August 1997 MN; **A9** October 1998 MN.

Marasmius oreades: **A7** November 1991 PH; **A9** June 1997 CB.

Melanoleuca melaleuca: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A9** October 1998 MN.

Meripilus giganteus: **H** September 1990 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A4** August 1997 MN; **A5** October 1997 RP.

Merulius tremellosus: **H** October 1989 PH; **A9** September 1998 CB.

Mycena alcalina: **H** October 1995 CD.

Mycena fibula: **H** October 1995 CD.

Mycena filopes: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Mycena flavoalba: **A9** October 1998 MN.

Mycena galericulata: **H** January 1987 PH; **A7** November 1991 PH; **H** October 1994; **H** October 1995 CD; **H** October 1996 CD; **H** October 1997 RP.

Mycena galopus: **H** October 1996 CD.

Mycena galopus var. *nigra*: **H** October 1994 CD.

Mycena haematopus: **H** October 1994 CD.

Mycena inclinata: **H** October 1997 RP; **A9** October 1998 MN.

Mycena leptocephala: **A7** November 1991 PH.

Mycena pura: **H** October 1995 CD; **A9** October 1998 MN.

Mycena vitilis: **A7** November 1991 PH.

Omphalina postii: **H** October 1995 CD.

Panellus stipticus: **H** January 1987 PH; **H** October 1994 CD; **A8** November 1998 CB.

Panaeolus foenisecii: **A9** September 1997 and September 1998 MN.

Panaeolus rickenii: **H** October 1996 CD.

Panus conchatus: October 1998 MN.

Paxillus involutus: **A7** November 1991 PH; **H** October 1994 CD; October 1995 CD; **H** October 1996 CD; **A8** July 1997 MN; **A5** October 1997 RP; **A8** August 1998 CB; **A9** October 1998 MN.

Peniophora quercina: **H** October 1996 CD.

Phallus impudicus: **H** October 1994 CD; **A8** July 1997 MN; **H** October 1997 RP.

Phellinus ferreus: **A8** September 1997 CB.

Phlebia radiata: **H** January 1987 PH; **A9** November 1998 CB.

Pholiota adiposa: **H** October 1994 CD; **A5** October 1997 RP.

Pholiota gummosa: **H** October 1995 CD.

Pholiota ochrochlora: **H** October 1996 CD; **H** October 1997 RP.

Pholiota squarrosa: **H** October 1994 CD; **H** October 1995 CD; **A9** June 1997; **A5** October 1997 RP; **A9** October 1998 MN; **A8** November 1998 CB.

Piptoporus betulinus: **H** January 1987 PH; **H** October 1989 PH; **H** September 1990 PH; **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A8** September 1997 CB; **A5** October 1997 RP; **A8** September 1998 CB.

Pleurotus dryinus: **H** October 1994 CD.

Pleurotus lignatilis: **H** October 1989 PH.

Pleurotus ostreatus: **H** January 1987 PH; **H** September 1990 PH; **A7** November 1991 PH; **A5** October 1997 RP.

Pluteus cervinus: **H** September 1990 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A9** September 1997 CB; **A5** October 1997 RP; **A9** October 1998 MN; **A7** November 1998 CB.

Podoscypha multizonata: **H** October 1994 CD; **H** October 1995 CD.

Polyporus brumalis: **A7** March 1997 CB.

Polyporus squamosus: **H** October 1996 CD; **A5** October 1997 RP.

Psathyrella candolleana: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Psathyrella conopilus: **H** October 1996 CD; **H** October 1997 RP.

Psathyrella gracilis: **H** October 1996 CD.

Psathyrella hydrophila: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD.

Psathyrella microrhiza: **H** October 1996 CD.

Psathyrella multipedata: **H** October 1994 CD.

Pseudotrametes gibbosa: **H** September 1990 PH; **H** October 1994 CD; **A9** September 1998 MN.

Psilocybe semilanceata: **A8** November 1997 CB.

Russula amoenolens: **H** October 1994 CD.

Russula atropurpurea: **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Russula cyanoxantha: **H** October 1989 PH; **H** September 1990 PH; **A7** November 1991 PH; **H** October 1994 CD; **A9** August 1996 CB; **H** October 1996 CD; **A8** July 1997 MN; **A9** August 1998 CB.

Russula fellea: **A7** November 1991 PH.

Russula foetens: **H** September 1997 RP; **A9** August 1998 CB.

Russula heterophylla: **H** October 1997 RP.

Russula lepida: **H** October 1995 CD.

Russula mairei: **A4** August 1997 MN.

Russula nigricans: **H** October 1994 CD.

Russula ochroleuca: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A9** September 1997 and September 1998 MN.

Russula sororia: **H** October 1996 CD.

Russula xerampelina: **H** September 1997 RP.

Russula parazurea: **H** October 1995 CD; **A5** October 1997 RP.

Schizopora paradoxa: **H** October 1996 CD.

Scleroderma areolatum: **H** October 1994 CD; **H** October 1996 CD.

Scleroderma citrinum: **H** January 1987 PH; **H** October 1989 PH; **A7** November 1991 PH; **H** October 1994 CD; **A4** August 1997 MN; **A8** and **A9** September 1997 CB; **A5** October 1997 RP.

Scleroderma verrucosum: **H** October 1989 PH; **A4** August 1997 MN.

Sebacina incrustans: **A9** May 1997 MN.

Stereum hirsutum: **H** January 1987 PH; **H** September 1990 PH; **H** October 1989 PH; **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A8** and **A9** June 1997 CB; **A5** October 1997 RP; **A9** September 1998 CB; **A8** January 1999 MN.

Stereum rameales: **H** October 1995 CD.

Stropharia aeruginosa: **A7** November 1991 PH; **H** October 1996 CD; **A9** September 1997 and September 1998 MN.

Stropharia aurantiaca: **A9** August 1996, September 1997 CB.

Thelephora terrestris: **A8** June 1997 CB.

Trichoderma viride: **H** October 1994 CD.

Tricholoma saponaceum: **A1** September 1998 MN; **A9** October 1998 MN.

Tubaria furfuracea: **A7** November 1991 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD.

Volvariella speciosa: **A9** September 1998 CB.

Volvariella bombycina: **H** September 1990 PH; **A9** September 1998 MN.

Vuilleminia comedens: **H** October 1996 CD.

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Aleuria aurantia: **H** October 1997 RP.

Ascoryne sarcoides: **A7** November 1991 PH; **H** October 1994 CD.

Ciboria viridifusca: **H** October 1996 CD.

Daldinia concentrica: **H** January 1987 PH; **H** October 1996 CD.

Helvella crispa: **A7** November 1991 PH; **H** October 1994 CD.

Hypoxylon fragiforme: **H** September 1990 PH; **H** October 1994 CD; **H** October 1995 CD.

Nectria cinnabarina: **H** January 1987 PH; **H** October 1996 CD; **A7** November 1998 CB.

Peziza badia: **H** October 1989 PH.

Xylaria hypoxylon: **H** January 1987 PH; **H** October 1994 CD; **H** October 1995 CD; **H** October 1996 CD; **A8** November 1997 CB; **A9** June 1998 MN.

Xylaria polymorpha: **H** October 1995 CD; **H** October 1996 CD; **A8** November 1997 CB; **A9** September 1997 and 1998 MN.

Birds (John Barrington)

Bird records from Hampstead Heath feature regularly in the Society's publications and in the annual *Hampstead Heath Ornithological Report*. However, these do not constitute the type of dataset needed to monitor the populations of species using the Heath, a key aim of any long-term survey work. When I joined the survey team, at the end of 1996, I decided that the most practicable way to achieve this aim would be to carry out regular counts of the waterbirds on the ponds, and to take sample counts of other species by walking a series of transects in different parts of the Heath. The results of these counts would give a useful baseline for monitoring short-term and (eventually) long-term changes in the bird populations.

This report summarizes the methods used for the counts and gives some key figures from the first two years' work.

Monthly counts

Transects. These cover (roughly speaking): Heath Extension, East Heath, Kenwood, and West Heath. All birds seen or heard within twenty-five metres either side of the route are counted. Dependent young and overflying birds are excluded. Counts started in January 1997. The average (mean) time for one counting session (four transects, from January 1997 to December 1998 inclusive) was 2 hours and 13 minutes.

Ponds. The sixteen larger ponds are visited (on the same day) each month. The ponds covered are: Swan, Watergarden, Leg of Mutton, Vale of Health, Viaduct, Mixed Bathing, Hampstead 1 and 2, Wood, Concert, Stock, Ladies' Bathing, Bird Sanctuary, Boating, Men's Bathing, and Highgate 1. All waterfowl and specialist waterside birds are counted. Dependent young and overflying birds are excluded. Counts started in February 1997.

Tables 1 to 4 give the key statistics for 1997 and 1998.

TABLE 1. Number of different species recorded overall.

	1998	1997
Transects	43	38
Ponds	17	18

TABLE 2. Highest number of different species recorded on specific transects/ponds.

	Year	Number	Location
Transects	1998	20	Kenwood
	1997	16	West Heath, Heath Extension
Ponds	1998	12	Hampstead 1
	1997	11	Hampstead 1

TABLE 3. Most frequently recorded species (number of transects/ponds on which recorded).

	Year	Species	Recorded on	Out of
Transects	1998[1]	carrion crow	48	48
	1997	carrion crow	45	48
Ponds	1998	coot	162	192
	1997	mallard	148	176

TABLE 4. Most abundant species (total count for the year).

	Year	Species	Total count
Transects[2]	1998	woodpigeon	367
	1997	woodpigeon	655
Ponds	1998	mallard	1,857
	1997	mallard[3]	1,781

Notes: [1] The blue tit was a close runner-up, with records on 47 transects.

[2] The woodpigeon's dominant position in 1997 is confirmed by the count for the next most abundant bird — carrion crow — which reached only 279. In 1998, however, the blue tit was a strong challenger, with a count of 335.

[3] This count was based on 11 visits only.

Population changes 1997–1998

Transect and pond counts use different protocols, so the results are given in separate tables. The species included have been restricted to those recorded on at least one transect/pond on each visit during the two years concerned. All calculations are based on the overall total count for each visit. It is too early in the survey to infer any trends from these figures. However, it is encouraging to see substantial increases in robin and mute swan counts (even if the latter started from a very low base!).

TABLE 5. Population changes on transects.

	% change	A	B	C	D	E
Blackbird	+ 37	10	13	2/14	3/24	24
Blue tit	+ 43	15	22	7/36	5/65	24
Carrion crow	− 22	20	16	10/36	7/45	24
Magpie	=	9	9	5/24	6/15	24
Robin	+113	8	16	2/16	3/37	24
Woodpigeon	+ 6	17	18	4/296	7/113	24

TABLE 6. Population changes on ponds.

	% change	**A**	**B**	**C**	**D**	**E***
Canada goose	− 6	25	24	8/34	3/40	23
Coot	+14	59	68	52/71	56/82	23
Mallard	− 5	179	171	99/221	86/210	23
Moorhen	+9	27	30	12/38	8/41	23
Mute swan	+150	3	8	1/6	2/9	23
Tufted duck	+26	47	59	20/90	20/72	23

Notes: Percentage change = B/A. A = median total count 1997; B = median total count 1998; C = minimum and maximum count 1997; D = minimum and maximum count 1998; E = total number of visits 1997–1998. * pond counts started in February 1997, so there were only 23 visits.

Further information

Print reports on the monitoring, including spreadsheets of the full transect and pond counts, are held at the Kenwood and Lido Information Centres, and at the Survey Base on the Heath Extension. An annual report appears as an appendix to the Hampstead Heath Ornithological Report (1997 onwards). Details are also published on my website (URL: www.johnwbar.dircon.co.uk).

Moles (C. Bowlt)

Moles are little seen but their presence is indicated by their molehills which are produced particularly in winter. This appears to be a real seasonal effect and not simply that the hills are more obvious in the shorter winter grass.

Fairly comprehensive surveys of molehills were carried out in the winters of 1996/7 and 1998/9. Many of the molehills on the Heath are quickly flattened by the feet of walkers and dogs. This, aided by the weather can make them difficult to identify after a few weeks, but some fresh ones were still being found in the middle of March. All those found were in grassland, or at the edge of woodland/scrub. None was found within woodland/scrub despite careful search and where they would in most cases have been easy to see with little or no undergrowth. Mellanby (1971) and other writers state that moles are not uncommon in woodland but do not make so many hills. I have certainly seen molehills in woods, e.g., Park Wood, Ruislip, but never many. According to Mellanby (1971) 'the most noteworthy fact regarding the wood [Monks Wood] as a mole habitat, is the paucity of "mole signs" . . . With careful examination, however, one realizes that burrows are very numerous even if few molehills appear'. Wheeler and May (1992), discussing their molehill survey, concluded that 'if moles exist in the ancient woodland of Epping Forest they are not creating new tunnels and thus molehills . . . It is our belief that they do not live in woodland in Epping Forest'. I am also inclined to think that the dearth of molehills in the wood/scrub on Hampstead Heath really does indicate an absence of moles living there.

The distribution of molehills on the Heath during the winters of 1996/7 and 1998/9 is shown in Figure 1 on a present or absence basis in each of the 100-m squares. The numbers of hills in a group typically varied between one and sixty-seven, but there was a remarkable 211 molehills beside the Ladies' Swimming Pool (was this significant, I wonder?). Details of numbers and locations are in the Survey records. They were widespread over the main body of the Heath comprising Kenwood, East Heath and Parliament Hill Fields, but were absent from West Heath, Golders Hill Park, Hampstead Heath Extension and Sandy Heath (except for a small group of hills in the Paddock). The absence from these areas is curious since they appear to be suitable for moles (except for most of Sandy Heath with little topsoil). The Extension was farmland until 1906.

Comparison between the survey results for 1996/7 and 1998/9 shows that the molehill distributions were similar and strongly suggests that at least most of the moles had not moved far, if at all, in the intervening two years. The data appear to indicate some movement into the north of Cohen's Fields, but molehills there might have been overlooked in 1996/7 (Figure 1).

Mellanby (1971) mentions moles killed by motor vehicles whilst crossing roads. It is my impression that roads form a very effective barrier to the movement of moles on the Heath. The moles of Hampstead Heath would seem to be an isolated island population surrounded by a sea of built-up area. Isolated populations of species are at high risk of extinction. If mole populations formerly present on the relatively small areas of West Heath and the Heath Extension suffered losses with no immigration it could have led to their disappearance. It will be interesting to see what happens to the very small population in the corner of Sandy Heath, or indeed to the whole of the Heath mole population in the long run.

How many moles are on the Heath? 'Moles hate their own species' (Mellanby 1971). The number of molehill groups found was 51 in 1996/7, and 46 in 1998/9. This would seem to indicate a minimum population of about fifty animals. It is stated that the numbers of moles present cannot be estimated from the number of molehill groups. Stone (1986) captured twenty animals within field pasture, although only four molehills were visible. The groups of molehills sometimes only occupied a few square metres, but this might not have indicated the full extent of the moles' territory but only an extension or a rebore. In one case a line of molehills ran for about seventy metres in addition to a spur halfway along. Each mole is said to maintain its own set of tunnels with only periodic extension, when molehills are produced.

References

MELLANBY, K. 1971. *The mole.* Collins, London.
STONE, D. 1986. *Moles.* The Mammal Society, London.
WHEELER, A. and MAY, A. 1992. The status and distribution of the mole in Epping Forest. *Lond. Nat.* **71**: 151–155.

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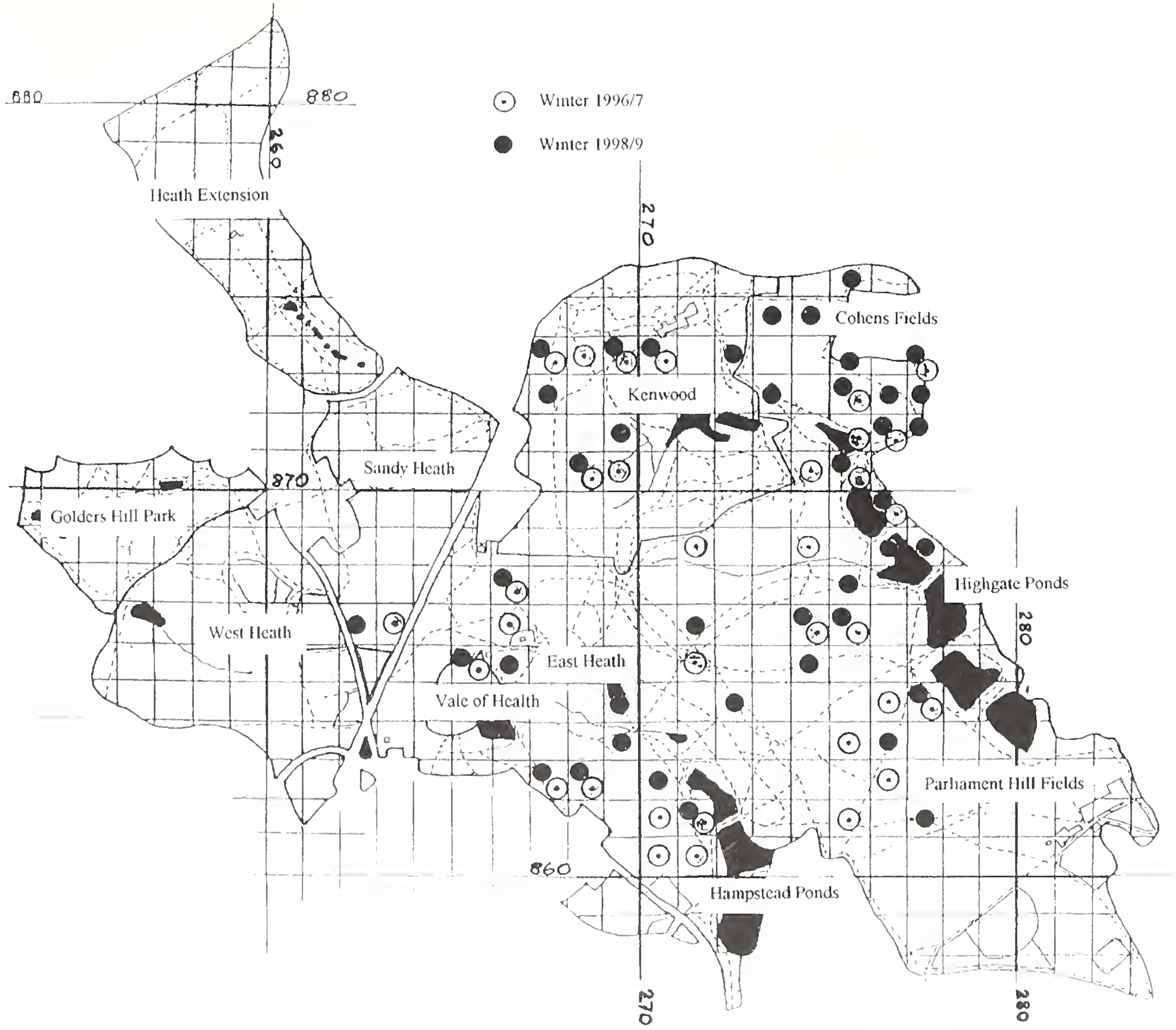

FIGURE 1. Distribution of molehills 1996/7 and 1998/9. Note the absence from the Extension, Golders Hill Park and West Heath. There appears little change in the intervening two years.

Book review

International Code of Zoological Nomenclature. International Commission on Zoological Nomenclature. Published by the International Trust for Zoological Nomenclature. 4th Edition, extensively revised. 1999. 306 pp., in English and French. £40, but 25 per cent discount to individual members of scientific societies. Available from ITZN, c/o The Natural History Museum, Cromwell Road, London SW7 5BD. ISBN 0 85301 006 4.

The origin of an internationally accepted Code of Rules for Zoological Nomenclature is a consequence of the confusion of names that occurred in the zoological literature in the early part of the nineteenth century. This was exacerbated by the subsequent growth of science and the exploration of countries outside Europe resulting in a multiplicity of names; many of them were synonyms arising from the work of scientists researching independently, and it became necessary to devise universally accepted methods for choosing between them. In 1842, many eminent scientists, including Charles Darwin and Richard Owen, were among those pressing for a stabilizing code for nomenclature, and it was at the Fourth International Congress of Zoology in Cambridge in 1898 that the present International Commission on Zoological Nomenclature was born.

This new and extensively revised fourth edition of the *Code* comes into effect on 1 January 2000 and entirely supersedes the current (1985) edition. Although authors of biological papers (both botanical and zoological) are aware of the need to cite correctly the Latin names of the species to which they refer, and usually to cite the classification they are following, it is not usual for such authors to be involved directly in the taxonomy or nomenclature. However, both botany and zoology have their respective *Codes* through which the stability of nomenclature can be maintained. The *International Code of Zoological Nomenclature* is the system of works and recommendations adopted originally by the International Congresses of Zoology and, since 1973, by the International Union of Biological Sciences. To quote: 'The objects of the *Code* are to promote stability and universality in the scientific names of animals and to ensure that the names of each taxon [a group of any rank in the hierarchy of classification of organisms, e.g., species, genus, family, order, etc.] is unique and distinct . . . . Priority of publication is a basic principle of zoological nomenclature; however, under conditions prescribed in the *Code* its application may be modified to conserve a long-accepted name in its accustomed meaning'.

The starting point for zoological nomenclature has been fixed arbitrarily as 1 January 1758 and two works are deemed to have been published on that date, the tenth edition of Linnaeus's *Systema Naturae,* which was published in 1758, and Clerck's *Aranei Svecici* (*Swedish spiders*) which was published in 1757. The names in Clerck's work have precedence over those of Linnaeus, and that is the only exception: names in any other work published in 1758 are deemed to have been published after the tenth edition of *Systema Naturae,* which when this concession was granted in the early 1950s was great news for arachnologists, although, of course, Linnaeus's contribution to arachnology is profound.

Like all rules, whatever the discipline, those of nomenclature are elaborate and intricate, and for the newcomer to biological writing may seem unending, but they are well thought out, tried and tested by systematists and taxonomists in their quests to apply the correct name to whatever species they are investigating. When you next puzzle over why the Latin name of a species that you are familiar with has changed, it is almost certainly due to a nomenclatural decision which could be that of the author of the work you have in front of you, or it could be based on a decision of priority that may have been referred to the Commission for a ruling due to parameters not readily agreed upon. For those not conversant with the principles of binominal nomenclature, but who would like an insight into its applications, I would strongly recommend a session with the *Code.*

K. H. Hyatt

Botanical records for 1998

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Abstract

Records of vascular plants from the London Area, a circle of forty miles across incorporating Middlesex and parts of five other vice-counties in the sense of Watson (1873), include aliens *Conyza parva* and *Ludwigia grandiflora* recorded for the first but probably not the last time in Britain, and *Apera interrupta, Calystegia* × *howittiorum* and *Euphorbia esula* recorded for the first time in v.c. 21 Middlesex.

Introduction

In his review for *Watsonia* of *Flora of New Zealand* vol. IV: *naturalised pteridophytes, gymnosperms, dicotyledons,* D.H. Kent wrote '*Conyza canadensis* is part of a complex, the true species being rare [in New Zealand], and the most widespread being the S. American *C. bilbaoana* E.J. Remy . . . *C. parva* Cronq. from N. America . . . is also present. Do we perhaps need to re-examine our British populations of *C. canadensis*?' *C. bilbaoana* was first found in Britain recently (Stanley 1996); now a first British specimen of *C. parva* has been found on railway property near Wood Green by David Bevan. For those who want to re-examine British populations of *Conyza,* I reproduce here the key by Webb et al. (1988), with the nomenclature updated as suggested by Kent. The capitula have to be examined on living flowering material.

1 Involucral bracts hairy, especially the outer; inner bracts 4–5.5 (–6) mm long 2
— Involucral bracts glabrous or with a few hairs on midrib or margin only; inner bracts 3–4 mm long 3

2 Cauline leaves flat; capitula 1.5-2 mm diameter; involucral bracts green; achenes1–1.2 (–1.4) mm long . . . . *sumatrensis*
— Cauline leaves undulate and sometimes twisted; capitula 2–3 mm diameter; involucral bracts green, distinctly tinged purple at apex; achenes 1.5–1.8 mm long . . . . *bonariensis*

3 Inner involucral bracts narrow-triangular; outer florets filiform or with inconspicuous ligules <0.5 mm long . . . . *bilbaoana*
— Inner involucral bracts linear; outer florets with evident ligules 0.5–1.5 mm long 4

4 Most involucral bracts with a distinct purple spot at apex; cauline leaves entire, glabrous on lower surface; stems with scattered hispid hairs or almost glabrous . . . . *parva*
— All involucral bracts green; at least some cauline leaves remotely serrate, sparsely to moderately hispid on both surfaces; stems sparsely to moderately hispid . . . . *canadensis*

In addition to the key characters, *C. parva* is commonly a shorter plant than *C. canadensis,* with narrower leaves.

A second American species to have made its first British appearance in London in 1998 is *Ludwigia grandiflora* (Michaux) Greuter & Burdet, which formed a patch of about four square metres in one of the shallow lagoons at the Barn Elms site of the Wildfowl and Wetlands Trust. This species is quite unlike the native *L. palustris* and the closely related plant which is established in a pond on Putney Heath. It has erect and very hairy stems arising from a base which creeps in damp mud under or near shallow water. The leaves are alternate and lanceolate. The flowers have five large bright yellow petals and ten stamens. The species has long been naturalized in south-west France, and recently has become very invasive in the Sologne, a region of dry sandy soils in central France where every farm has its own reservoir. The oldest of these artificial ponds were created in about the fifteenth century and are now important sites for rare plants and breeding birds. Last summer I was shown a farm pond in the Sologne, where in two years *L. grandiflora* had increased from nothing to cover about 100 square metres, by the proprietor who used it as a source of fish for his excellent restaurant, and was at a loss to know how to get rid of the plant. It did not help him that I was able to show an excellent drawing of the plant in the flora of Coste (1900–6) where it is named incorrectly as *Jussiaea repens* L. *Jussiaea,* with a double whorl of stamens, is no longer regarded as separable from *Ludwigia,* and the *repens* of Linnaeus is a different species. In *Flora europaea* (Raven 1968) the species is named *L. uruguayensis* (Camb.) Hara. When Neil Anderson showed me a specimen of it a few weeks after I had come back from France, I was able to identify it instantly. Floating pennywort *Hydrocotyle ranunculoides* occurred with it at Barn Elms and it is likely that both species were accidentally introduced with other aquatic plants. The WWT has attempted to eliminate them both.

Several other 1998 records of *Hydrocotyle ranunculoides,* from localities in the Lea Valley and South Essex, are not included here as I shall be publishing them elsewhere.

V.C. 16, West Kent

From Bexley, David Nicolle's records include yellow vetchling *Lathyrus aphaca* from 'waste ground' at Upper College Farm. There are several localities in Kent where this species is established in quantity, but they are all further from the centre of London. In Joyden's Wood at the edge of the borough, Joyce Pitt found hard fern *Blechnum spicant,* probably the same plant previously reported by Ray Clarke in 1976, and several old stools, but also young trees, of small-leaved lime *Tilia cordata.* In a wood on the bank of the Cray north of Crayford, John Palmer found a good-sized patch of naturalized summer snowflake *Leucojum aestivum* subsp. *pulchellum.* The Borough of Bromley extends far into rural territory, but it was in High Brooms Wood that Geoffrey Kitchener found both abundantly naturalized three-cornered garlic *Allium triquetrum* and hairy garlic *A. subhirsutum* extending for three metres along a path; ancient woodland entirely surrounded by housing is at risk from such occurrences. Sue Buckingham's record of narrow-fruited corn-salad *Valerianella dentata,* now almost extinct in London, from Hewitt's Bank nature reserve near Pratt's Bottom, is taken at secondhand from the annual report of the Orpington Field Club.

From the same source of records I take autumn lady's-tresses *Spiranthes spiralis* in a garden in Kemsing, found by Bud and Barbara Collins; this orchid does not seem to be extant elsewhere in this part of our area, of which it is at the extreme edge. Pat Eade's record of early gentian *Gentianella anglica* is from the North Downs above, where it was previously found by Francis Rose more than fifty years before. In its second West Kent locality near Shoreham it still lingers. The club's botanical records are compiled by Mrs Pitt, whose own 1998 records of greatest interest to me are those which I can relate to older observations; her own of many years ago in the case of bristle club-rush *Isolepis setacea* and yellow sedge *Carex viridula* subsp. *oedocarpa* in Joyden's Wood, Ray Clarke's of about thirty years ago in the case of catmint *Nepeta cataria* in a scrap of hedgerow near Knatt's Valley. Another useful source of records from Kent is the *Bulletin of the Kent Field Club,* with accounts of their meetings; among plants seen in the Swanscombe area at their meeting of 6 September were a new colony of round-leaved wintergreen *Pyrola rotundifolia* and creeping willow *Salix repens* considered to be of the coastal variety *argentea.* From John Palmer's long list I select for mention only purple viper's bugloss *Echium plantagineum,* not with other garden plants, in chalk grassland and partly cleared scrub at the edge of our area at Hartley. My own best record is of a large colony of common cudweed *Filago vulgaris,* which is not quite as rare as it was a few years ago, in a very rabbity area of golf course works near Eynsford.

V.C. 17, Surrey

In addition to the *Ludwigia* mentioned in the introduction, Neil Anderson collected at Barn Elms pale galingale *Cyperus eragrostis*, another alien aquatic, which produces abundant small seeds and may therefore be of value to the birds for whom these lagoons have been created. I also had records from the Borough of Richmond upon Thames from Elizabeth Norman, including sowbread *Cyclamen hederifolium* at Lonsdale Road Reservoir in a situation where it could not possibly have been planted, Mary Clare Sheahan and Paul Bartlett, including prickly sedge *Carex muricata* north of the marina on Ham River Lands. A consequence of my efforts to associate records with the correct borough is that I have to distinguish Putney Heath in Wandsworth from Wimbledon Common in Merton, although there is no obvious break between them. John Hodge suggests that his discovery of a new site for hard fern *Blechnum spicant* on 'Putney Heath' indicates the beneficial effect of reduced levels of atmospheric pollution in London. I attended the launch of the London Ecology Unit's handbook *Nature conservation in Merton* at the Poplar First School in Morden. Adjacent derelict tennis courts have been incorporated into the school grounds to make a very satisfactory and well-documented nature garden. Many shrubs have been introduced but the abundant stone parsley *Sison amomum* is quite wild, and there is one shrub which has been there longer than the school and of which three generations are present. This has been identified as Mount Etna broom *Genista aetnensis* (Raf. ex Biv.) DC., a new species for the London Area, though there is an earlier record from Surrey (Leslie 1987). John Archer sent me a very interesting plant list from Bandonhill Cemtery near Beddington in Sutton, which appears never to have been investigated before: native species present included prickly sedge *Carex muricata*, crested hair-grass *Koeleria macrantha*, spreading meadow-grass *Poa humilis*, meadow saxifrage *Saxifraga granulata*, knotted clover *Trifolium striatum* and subterranean clover *T. subterraneum*. John Bedford sent me a long list of casuals, including bladder ketmia *Hibiscus trionum*, from the Tramlink construction site in South Norwood Country Park; this park is now all in Croydon, although only the smaller part of it is in v.c. 17. At the Wild Flower Society meeting on 20 June, lesser sea-spurrey *Spergularia marina* was an unexpected discovery at the edge of the road on the west side of Purley Way.

A useful source of Surrey records is the annual *Surrey Flora Committee Newsletter*. The report for 1998 has two records of corn parsley *Petroselinum segetum* which is very rare in Surrey, both from just within our area, a large quantity of it at Brockham found by J. Coombes and A. Sankey and a whole lot more at the Leatherhead interchange of the M25 motorway found by Ken Page and John Dicker, whose records also include a good quantity of catmint *Nepeta cataria* at a field border at Brockham and a few plants of a hybrid eyebright *Euphrasia anglica* × *E. nemorosa* at Juniper Bottom, the first record of this hybrid in Surrey for about seventy years. The *Newsletter* states that the June meeting of the Committee found unhybridized cut-leaved selfheal *Prunella laciniata* still extant at Dawcombe nature reserve, contrary to previous reports. I visited Titsey Park where the house and grounds were open to the public for the first time. Hoary cinquefoil *Potentilla argentea* was an unusual weed to find abundantly self-sown in the walled garden, and by the lower lake there is an abundance of great burnet *Sanguisorba officinalis*. This is probably extinct as a native plant in Surrey; at Titsey it is among other native species, but it is not unlikely that all were introduced early this century. Geoffrey Kitchener found a great mixture of *Epilobium* hybrids and one plant of pale galingale *Cyperus eragrostis* in a reservoir pit at the East Surrey Water Company's works at Godstone.

V.C. 18, South Essex

Peter Tymkow sent me some interesting records from Newham, including pink-headed knotweed *Persicaria capitata* persistent at the base of a tree in Green Street, Upton Park, perhaps a first record for Essex, and a vigorous patch of hairy finger-grass *Digitaria sanguinalis* on a pavement in Romford Road, Forest Gate. I spent a few hours in the western part of this borough in June; a couple more grasses were my best finds then, a casual Highland bent *Agrostis castellana* in a shrubbery near Puddingmill Lane Station and a quantity of fern-grass *Catapodium rigidum* on industrial premises near the Three Mills Wall River. John Archer took a group from the Small Field Club in the much-changed area north of Barking power station in Barking & Dagenham on 15 May; among the plants they found were a clump of Turkish iris *Iris orientalis* which the bulldozer had missed, and two plants of hairy garlic *Allium subhirsutum* on the south edge of River Road. Ken Adams saw dense masses of spineless saltwort *Salsola kali* subsp. *ruthenica* along the central reservation of the M11 motorway in (and beyond) Redbridge and in the same borough a two-square-metres clump of longleaf *Falcaria vulgaris* on the verge of Centre Road on Wanstead Flats. I tried to refind plants seen at Walthamstow Reservoirs in Waltham Forest at LNHS meetings in the 1970s for the Atlas 2000 project; many of them had gone, though upright hedge bedstraw *Galium mollugo* subsp. *erectum* is still present in quantity though severely mown, and musk thistle *Carduus nutans* is still on a causeway between the two reservoirs. I think the good pure material of short-styled field-rose *Rosa stylosa* which Dr Adams found in Epping Forest near Chingford is also just in the same borough.

Beyond the London boundary in Essex, Dr Adams found about fifty plants of keeled-fruited corn-salad *Valerianella carinata* in Queens Road, Loughton. Recording for Atlas 2000, Robin Blades found viper's bugloss *Echium vulgare* and twiggy mullein *Verbascum virgatum* in the Sewardstone area. John Davidson reports a bird-sown Himalayan honeysuckle *Leycesteria formosa* by the Loughton Brook in Epping Forest. Pat Sellar mentioned divided sedge *Carex divisa* still on Rainham Marsh in our *Newsletter*.

V.C. 19, North Essex

Our 1998 records from this vice-county all derive from our meeting on 13 June, which visited the area around Fishers Green, mostly on land managed by the Lee Valley Regional Park Authority. It would be nice to be able to add Cheddar pink *Dianthus gratianopolitanus* to our wild flora, but there is absolutely no doubt that this species, like corn-cockle *Agrostemma githago,* wild candytuft *Iberis amara,* large thyme *Thymus pulegioides,* wild marjoram *Origanum vulgare,* clustered bellflower *Campanula glomerata* and other plants nearby were all deliberately planted. They looked just as incongruous in this location as the drystone wall prolonging the bank on which they grow, and one is left wondering about the status of green-winged orchid *Orchis morio* and yellow-rattle *Rhinanthus minor* in the meadow nearby, where my not very out-of-date map shows a flooded gravel-pit.

V.C. 20, Herts.

The same meeting started and finished at Cheshunt Station in Herts., north of which there was a *Lathyrus* which I subsequently identified as sweet pea *L. odoratus*. Rob Dyke found the rare weed broad-leaved spurge *Euphorbia platyphyllos* at the edge of a cornfield on the west side of Wormley Wood. Philip Oswald's list of localities for lesser sea-spurrey *Spergularia marina* (Oswald 1999) includes four in our area by or near the M25 motorway in Herts.

V.C. 21, Middlesex

The same species is recorded in the same source from the west side of Hanger Lane, an unusually urban location for a plant of salted roads. More centrally in Ealing, Jill Collar's records include the cut-flowered variety of large bindweed *Calystegia silvatica* var. *quinquepartita* as a garden weed and Neil Anderson found compact brome *Anisantha madritensis* on a roadside. Neil found both this grass species and water bent *Polypogon viridis* at Ravenscourt Park in

Hammersmith & Fulham, the latter in the grounds of a hospital where it was perhaps introduced with aquatic plants, though it has since increased. Continuing eastwards into Kensington & Chelsea, Elizabeth Norman still finds interesting plants in Holland Park; in 1998 these included one dark mullein *Verbascum nigrum* and stone parsley *Sison amomum*. Tim Freed and others found a bee orchid *Ophrys apifera* in Kensal Green Cemetery. With Elinor Wiltshire, Mr Freed found about a hundred plants of moth mullein *Verbascum blattaria* in an enclosure in Kensington Gardens. Mrs Wiltshire's many additional plants from Hyde Park and Kensington Gardens are reported elsewhere in these pages, and in another locality in Westminster she found a small but well-established colony of coral-root *Cardamine bulbifera*. David Nicolle reported 'wall-to-wall' spring beauty *Claytonia perfoliata* near Marlborough House.

Moving to the eastern side of the vice-county, I have Tower Hamlets records from a number of members. There are several reports of Deptford pink *Dianthus armeria* on the Isle of Dogs, but it was surely sown and unlike other deliberate introductions there cannot be expected to persist. Not far away I saw a lot of natural-looking knotted bur-parsley *Torilis nodosa* in grass near the Asda car park. Dr Adams found another group of *Valerianella carinata* in gaps in paving, just into Middlesex at Bow. John Edgington's records include cut-leaved deadnettle *Lamium hybridum* in Stepney Green, several patches of *Allium subhirsutum* at Old Ford and London rocket *Sisymbrium irio* in a number of places. *Conyza parva,* mentioned in the introduction, is not the only remarkable discovery by David Bevan on abandoned railway sidings near Wood Green; there were also about fifty plants of *Verbascum blattaria,* one of ternate-leaved cinquefoil *Potentilla norvegica,* the sticky groundsel – Oxford ragwort cross *Senecio* × *subnobredensis* with its parents, field mouse-ear *Cerastium arvense,* rescue brome *Ceratochloa cathartica,* small-flowered evening primrose *Oenothera cambrica* and more. Of other plants seen by Mr Bevan in Haringey, including seedlings of Indian pokeweed *Phytolacca acinosa* in Priory Park, hound's-tongue *Cynoglossum officinale* at Railway Fields (how can that have got there?), the hybrid of hedge and hairy bindweeds *Cynoglossum* × *scanica* on the fence of St Ignatius' church, Tottenham and other street weeds, many were first found by Brian Wurzell. I have numerous records from Enfield this year, through the kindness of the staff of the London Ecology Unit, who allowed me to examine their survey records from this borough, for which one of their excellent handbooks is projected. I was particularly impressed by their observations from the Forty Hall estate, which include small quantities of adder's-tongue *Ophioglossum vulgatum* and ragged robin *Lychnis flos-cuculi,* and from a pasture near Clay Hill to which there is no public access, though betony *Stachys officinalis,* pepper saxifrage *Silaum silaus* and devil's-bit scabious *Succisa pratensis,* etc., can be seen from the fence.

Our own Hampstead Heath Survey continues to turn up interesting plants in the Boroughs of Camden and Brent. The only significant possibly native specimens not seen before are ferns, plants of hard fern *Blechnum spicant* and scaly male-fern *Dryopteris affinis* reported to me by Anthony Vaughan and Howard Matthews, but there are also more than one generation of non-native royal fern *Osmunda regalis* and ostrich fern *Matteucia struthiopteris* brought in accidentally from another place. The aliens in a gully in Parliament Hill Fields have received well-merited attention. In 1998 they include the first Middlesex and third London Area record of *Anoda cristata,* as well as velvet-leaf *Abutilon theophrasti,* mintweed *Salvia reflexa* and niger *Guizotia abyssinica,* which I have taken from George Hounsome's list. These probably all have an origin in birdseed.

Mr Vaughan produced an interesting pink-flowered *Calystegia* specimen from the edge of a sports field north of Highwood Hill in Barnet, which had previously been identified as hairy bindweed *C. pulchra,* but lacked the short pubescence of that species. He sent it to Dr R.K. Brummitt at Kew, who determined it as '95% certainly *C.* × *howittiorum*', the hybrid of *C. pulchra* and *C. silvatica*. It is the first Middlesex record of the hybrid. Our only Harrow record in 1998 was a very tall *Senecio* in a garden in South Harrow which I mention only because I have seen my suggestion that it might be *S. vernalis* converted into a firm, and probably wrong, identification as that species. In Hillingdon, David Bevan found about a dozen plants of common milkwort *Polygala vulgaris* and a score of Smith's pepperwort *Lepidium heterophyllum*, both rare plants in v.c. 21, on what is left of Pield Heath near Cowley Peachey. Peter Ellison found a strange mixture of mostly casual plants on disturbed ground near the Ruislip Lido, including about twenty-five spring starflower *Tristagma uniflorum* and knotted clover *Trifolium striatum*. Also near the Lido were burnet rose *Rosa pimpinellifolia*, surely, though not obviously, planted here and perhaps also its hybrid *R.* × *hibernica*. From Hounslow, Mr Hounsome reported a wide scattering of dense silky-bent *Apera interrupta*, another new plant for Middlesex, and a presumably casual great/dark mullein hybrid *Verbascum* × *semialbum* from Feltham Marshalling Yards. Ron Parker found about twenty plants of pink-headed knotweed *Persicaria capitata* outside the Red Lion, Brentford.

Another new plant for Middlesex was found very close to the Bucks. boundary in the area which is now administratively the Spelthorne district of Surrey. There have been a few published records before of leafy spurge *Euphorbia esula* in the vice-county, but my predecessor as its recorder, Duggie Kent, very reasonably assumed that all were errors of identification, referring to its hybrid twiggy spurge *E.* × *pseudovirgata* which is much more commonly naturalized. *E. esula* has broader, more obtuse leaves, and was discovered independently by Mr Hounsome and Barry Phillips on the bank below the slip-road taking traffic from the A30 westbound to the M25 southbound. Mr Phillips was investigating the flora of the privately owned Hilda May nature reserve, where he also found the uncommon aquatics fan-leaved water-crowfoot *Ranunculus circinatus*, thread-leaved water-crowfoot *R. trichophyllus* and hair-like pondweed *Potamogeton trichoides*, as well as a fair quantity of blue fleabane *Erigeron acer* on the bank.

V.C. 24, Bucks.

Philip Oswald's records of *Spergularia marina* already mentioned include one from the M25 motorway in Bucks., just north of the M40 junction. Peter Ellison sent me a number of interesting Bucks. records, including a specimen of yellow vetch *Vicia lutea* occurring casually only just outside our area near Chalfont St Peter.

References

COSTE, H. 1900–1906. *Flore descriptive et illustrée de la France, de la Corse et des contrées limitrophes*. Paris.

LESLIE, A.C. 1987. *Flora of Surrey supplement and checklist*. Guildford.

OSWALD, P. 1999. *Spergularia marina* on inland roadsides (2). *BSBI News* **80**: 29–30.

RAVEN, P.H. 1968. *Ludwigia* L. *In* Tutin, T.G., et al. eds. *Flora europaea* **2**: 308.

STANLEY, P. 1996. *Conyza bilbaoana* J. Rémy — new to South Hampshire (v.c. 11) and to Britain. *BSBI News* **73**: 47–49.

WATSON, H.C. 1873. *Topographical botany*. Dundee.

WEBB, C.J., SYKES, W.R. and GARNOCK-JONES, P.J. 1988. *Flora of New Zealand* **4**. *Naturalised pteridophytes, gymnosperms, dicotyledons*. Christchurch.

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Obituary

PIERS WILLIAM EDWARD CURRIE, MC, MA (Oxon.)
1913–1999

The death of Piers Currie on 21 January 1999 was received with sadness. Piers joined the London Natural History Society in 1936 and was a prominent active member until he left the London area in the mid 1950s.

It was in 1936 that the Society commenced its Survey of Limpsfield Common and Piers joined the panel of recorders. He produced a preliminary list of the birds for 1937. The following year he conducted a census of the winter birds on the Common as well as producing a preliminary account of the breeding birds. He also reported on a rare ichneumon wasp from Limpsfield. The same year he described the autumn association between thrushes and hawfinches on Mickleham Downs. As well as being involved with Limpsfield Common, he was an active member of the Society's bird-ringing team. But the Second World War intervened and the Survey of Limpsfield Common ceased, and Piers was commissioned into the 4th Regiment, Royal Horse Artillery. He served with distinction in the Middle East, being wounded twice, and he was awarded the Military Cross in north-west Europe.

After the war Piers again became involved in our activities. He resumed his position on the editorial committee of the *London Bird Report,* and in 1947 he was responsible for organizing the Ecology Section's City Bombed Sites Survey, contributing the annual Progress Reports as well as papers on the birds and the sawflies. In the *London Bird Report* No. 12 for 1947 he detailed the breeding of the black redstart in the London Area. In 1949 Piers took over the editorship of *The London Naturalist* for four years. In 1950 he contributed a paper to *LN* **29** on summer resident birds of the Western Plains of Bookham Common. In *LN* **48** (1969) Piers published a preliminary list of the sawflies of Bookham Common collected between 1946 and 1955. In 1952 he joined the Joint Committee of the LNHS and the Kent Ornithological Society which was set up to manage the newly formed Dungeness Bird Observatory.

Piers Currie was born in Kensington, London on 26 February 1913, but when a few weeks old was brought to Esher, Surrey where the family lived until 1923. They then moved to Cheam to the house where Piers's sister Maureen still lives. After first attending a local school in Esher, run by Miss Biggs, Piers, at the age of eight, went to a boarding school, Streete Court, in Westgate-on-Sea, Kent where he remained until winning a scholarship to Rugby where he eventually became Head of School. When due to leave Rugby, Piers was asked by the new headmaster, Mr Lyons, to stay on an extra term to assist him in his new post. Piers won a scholarship to Oxford and went to Brazenose College, where he narrowly failed, through sickness, to get his expected First in Greats, but the following year he succeeded in gaining a First in Law. After Brazenose he and a friend went on an extended trip to the Middle East, visiting Afghanistan and Persia (Iran). On his return he joined a firm of London solicitors. Following military service, Piers served in turn as Legal Adviser to the National Coal Board and the Land Commission. He was then appointed a judge, being Deputy Master of the Court of Protection. After retirement in 1978, Piers took holy orders, and with his wife Rosaleen, the daughter of a clergyman and the adjutant of the WRAC (TA) Battalion for Essex, Suffolk and Norfolk, whom he married in 1956, moved to Norfolk where he was ordained. He served in several parishes and for a number of years was attached to the Cathedral staff in Norwich where he gained a reputation for meticulously prepared sermons with clarity of thought and strength of delivery. He also served as Warden of the College of Chaplains and as Assistant Priest of St Mary in the Marsh, it being the parish of the Cathedral. At parties he had a reputation for generosity and attentiveness.

Piers had, from an early age, been interested in wildlife and his sister Maureen recalls him at about the age of eight chasing a clouded yellow butterfly on the Isle of Wight. It was his lifelong interest in natural history, especially ornithology, which brought him to live near the marshes of north Norfolk. He visited Peter Scott at the latter's windmill at Cley. Piers was a skilful gardener and had an allotment the envy of his neighbours. He loved books — travel, history, biography, philosophy, and especially Greek and Latin classics: he translated all the Greek and Latin wall-tablets and ledger-stones in Norwich Cathedral. Much of his large collection of wasps, sawflies and butterflies went to the Natural History Department at Gresham's School, Holt, Norfolk in 1981, and some specimens went to a friend at Cambridge University.

A thanksgiving and memorial service to Piers was held in Norwich Cathedral on 22 February 1999. To Piers's wife Rosaleen and his sister Maureen we extend our sincere condolences and we share in their sad loss.

KEITH H. HYATT

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Obituary

DOUGLAS HENRY KENT, OBE, 1920–1998

Duggie Kent was Britain's leading authority on plant nomenclature. His published works were numerous; by far the most important for us was *The historical flora of Middlesex*, which appeared in 1975. His name was in every edition of the *Programme* of the London Natural History Society from 1952 to 1971, in one place or another. The question which I expect readers of this biographical notice of him might seek an answer to is why, after twenty-eight years of membership of the LNHS, he did not renew it in 1972 or ever again.

One might also wonder what got him interested in botany in the first instance, but information about this is totally lacking. A 'list of county floras in preparation' in the 1951 *Year Book* of the Botanical Society of the British Isles indicates that he had started work on a flora of Middlesex, covering flowering plants, ferns and charophytes, in 1939. The material surviving, not from quite so early a date, includes a compilation of first records of plants in Middlesex, among which is his own record of *Matricaria matricarioides* in 1931 (he subsequently found an earlier one). As he was only eleven years old in 1931, perhaps there had been a teacher at his primary school who kindled his enthusiasm. The final text of his *Historical flora* puts the beginnings of his studies in 'about 1932'. His earliest published Middlesex records are dated 1939, but he first noticed *Lepidium latifolium* on the bank of the Grand Union Canal near Rickmansworth, just across the border in Herts., in 1937.

Nothing indicates that this interest was inculcated by his parents. Ernest Kent was an inspector for the Gas, Light and Coke Company. His only child Douglas was born at home, 34 Richmond Road, South Hammersmith, on 21 March 1920. Six years later they moved to 75 Adelaide Road, West Ealing, which was Douglas's address for the remainder of his life. When he left Bordeston Secondary School at Boston Manor at age fifteen, Douglas followed his father into the Gas, Light and Coke Company as a clerk. The Company became part of the North Thames Gas Board and then part of British Gas, and he became a section leader in the Supplies Division, working on mains and pipelines, but his employment was in effect continuous until his retirement on 31 August 1980. Except for the occasional plant record from the canal at Stepney, which the British Gas pipeyard backed on to, he kept his working and botanical lives strictly separated. I would imagine that at work he was always Mr Kent. With us he was Duggie (or sometimes Doug). I had never seen this written down when I first wrote a letter to him in about 1972, and began 'Dear Dougie'. His reply came back signed 'Duggie' crossed out and replaced by 'Dougie'.

Looking at the volume of his botanical work, it is difficult to see how it fitted in with full-time employment. This was not interrupted by war, as was usual for men of his generation, but it was by illness. The first of several operations took place before the outbreak of war. These must have been successful, for he led an active life uninterrupted by serious illness for more than thirty years afterwards. However, the hospital stay did have a profound effect on his life; on 10 July 1944, he married Ivy Minnie Austen, who had nursed him and continued her benevolent rule over him until her own death on 7 March 1997.

By modern standards, the brick terrace houses in Adelaide Road are small, with two 'reception' rooms on the ground floor, a kitchen leading out into the back garden, and three small bedrooms on the upper floor. The young couple moved in to the upper floor, using the middle bedroom as their living/dining room and the back bedroom as their kitchen; Douglas's parents lived downstairs. After Michael was born, on 14 June 1946, the upstairs back room became his, and presumably all generations in the house must have used the downstairs kitchen. It was not until after the deaths of his mother in 1960 and his father in December 1962 that Duggie and Ivy were able to occupy the whole house. This must have been a relief, for Duggie had by then amassed a herbarium of about 1,500 specimens, a fair-sized botanical library and a large number of botanical notebooks and folders, not to mention a stamp collection, a gramophone, trainspotters' manuals, etc.

The notebooks are the only source of information about his earliest botanical activity. Most of the smaller ones came from his company stores. He numbered them all, some of them in a separate sequence with the numbers prefixed MS, being material for his flora, but that sequence appears to have been started later, in about 1950. Those including his field notes, notes made in herbaria and libraries, and in the earliest ones trainspotters' lists of numbers, only got up to N.3 by the middle of 1945, but the last in sequence is N.113 dated 1983 (after that he did what other abstractors had been doing for decades: he wrote notes on loose cards which can be filed in sequence ready for the printer). His notes on the flora of Middlesex were written into the margins of an interleaved copy of Trimen & Dyer's *Flora of Middlesex* until he first wrote out a draft of his own flora in about 1950.

In 1944 he joined the LNHS and the Botanical Society and Exchange Club, soon to be transformed into the BSBI. In our case, he probably joined early in the year, as by March he was surveying local bomb sites in Ealing, although they were of no particular botanical interest. (He found a lot more on bomb sites in Canterbury, which he first visited in the spring of 1943, not long after the first devastating German bombing of that city on 31 May 1942, and again many times, en route to Ivy's family. These finds were written up in a paper published in *Watsonia* **2** (1), June 1951.) It is not clear whether he first met J.E. Lousley and other botanists before joining either Society, and was encouraged by them to join, or as a result of joining. What is certain is that the middle 1940s were the busiest years of his botanical life. He kept a list of 'Middlesex localities visited' separate from his notebooks which shows a total of 249 dates in the five years 1943–7, not all of which produced anything worthy of a field note, and he also went occasionally into Surrey and Bucks. as well as Middlesex and Kent. He checked on all sources of records cited by Trimen & Dyer, and trawled through all subsequent works, printed and manuscript, which he could find in the libraries of the British Museum (Natural History) and Kew to add more. Sir Christopher Andrewes offered Duggie a sight of the manuscript *Flora of Highgate* which he had compiled between 1915 and 1921, and Duggie wrote the whole thing out in his own hand. He went systematically through the herbaria at Kew and South Kensington, making notes of all the Middlesex specimens he could find. He copied out data on climate, topography, Inclosure Acts, commons registration, etc., from reference works, and the entire text of *British Standard 1629:1950, Bibliographical references*. The object of all this activity was his own *Flora of Middlesex,* of which a first draft was ready by about 1950, all handwritten except for the introductory matter which was typed, some pages many times. His earliest published papers, 'Notes on the flora of Middlesex, 1939–46' (*The London Naturalist* **26**: 56–65), 'Middlesex plant records for 1947' (*LN* **27**: 29–35), 'Middlesex plant records for 1948' (*LN* **28**: 31–36), two in *LN* **29** (1950), 'Additions and corrections to the Comital Flora for Middlesex' (*Watsonia* **1**: 92–101, 1949), 'John Blackstone, apothecary and botanist, 1712–53' (*Watsonia* **1**: 141–149, 1949) and 'Notes on the flora of Kensington Gardens and Hyde Park' (*Watsonia* **1**: 296–300, 1950), consisting of observations 'during the course of about a score of visits made between the spring of 1947 and the autumn of 1949', can all be regarded as spin-offs from his flora project. There were others which never saw the light of day. 'The extinct plants of Middlesex' was never even typed, and may have been composed as early as 1944. 'Some unpublished and little known Middlesex records', dating from about 1949, records his 'Grateful thanks . . . to Mr A.J.Wilmott for much assistance while working in the European Herbarium at South Kensington', while 'Soya bean adventives in Middlesex' from about the same date, the typescript of which has a few emendations in Lousley's hand, has as its starting point the discovery in 1945 of a plant near a flour mill at Springwell, in the north-west corner of the county, by Barbara Welch, whose obituary in *Watsonia* he was to write more than forty years later. In the next few years, Duggie visited the mill many times, alone or in the company of Lousley, or Mrs Welch, or Francis Rose, or others, finding many plants not previously found in Middlesex. One of them was *Ipomoea lacunosa* L., not previously found in Britain, and the subject of the first item by him in the series 'Plant notes' in the BSBI's journal *Watsonia*. The series was transferred to the *Proceedings of the BSBI* when they started in 1954, and eventually Duggie was to contribute thirty-seven items to it. Some of the soya bean adventives also turned up on a tip at Hanwell, much nearer to Ealing, which Duggie visited many times. The harvest of these visits was a 'Flora of Hanwell Tip', which he wrote out into a small notebook, of the kind one could get from Woolworth's for threepence. This activity was typical of him, and in this case not at all useful, as the 'Flora' is simply a list of names, in systematic sequence, without any indication of date. Nor does it say where the tip was located, though that can be worked out from the published account of the BSBI excursion he led to it on 27 September 1947.

Not everything he did was directed to his flora project. In 1949 the BSBI *Year Book* had included a request from John Hillaby to help with the Hampstead Heath Survey, to which of course Duggie responded enthusiastically. The Survey had started in 1939, and Hillaby had also amassed many older documents. Duggie's contribution was a cyclostyled 'Check list of Hampstead plants'. In the same period he began to try growing things in his father's garden. He got *Abutilon theophrasti* to grow from seed collected at the Springwell soya mill, but had less success with what he called *Dentaria bulbifera,* on which he planned a contribution to the series 'Biological flora of the British Isles'. The plants died of drought after a few months, and the contribution was never submitted. It was when he visited Garret Wood on the Herts./Middlesex border to examine the population of *Cardamine bulbifera* there, on 25 March 1950, that he discovered that the 'entire Middlesex portion of the wood had been cleared in connection with chalk quarrying'. Later he collected fuchsias and stapeliads in a greenhouse, and of course, literature about them too.

Although Lousley was the LNHS Recorder, this did not prevent Duggie from starting a notebook with his own *Hand List* addenda. Maybe this was the basis for his paper 'A contribution to the flora of Central London' in *LN* **39** (1960), followed by its own corrigendum and two supplementary papers. The 'Additions and corrections to the flora of central London' in *LN* **41** (1962) included few records of his own, of which two were from Lord's and two from the Oval.

Though I have surmised that Duggie had a draft of his own flora ready by about 1950, nothing suggests that he had any thought of publishing it at that time. He was far too busy with the affairs of both societies he had joined. In 1948 he had become chairman of the LNHS Botany Section, an office he was to hold for six years. He was then already curator of the Society's herbarium, and later for a few years curator of all its collections, a post which for a couple of years (1954 and 1955) required him to present reports on such non-botanical subjects as bird skins. He continued to be responsible for the herbarium until 1961, soon after which it was given away. He remained on the Botany Section Committee for the rest of his time in the Society. More time-consuming than any of these must have been the compilation of the 'Hand list of the plants of the London Area'. Although in his 'Botanical records for 1948' Lousley had written that 'A considerable amount of work is necessary before a new edition of *Records of the London Area* can be contemplated', *A Hand List of the Plants of the London Area,* which was in effect a vastly improved new edition of our pre-war publication, started appearing as supplements to *The London Naturalist* only two years later, and was completed in seven annual parts, with the names of Kent and Lousley as joint compilers. It is difficult now to sort out who did which parts of the work. It is reasonable to surmise that much of the work of preparing material for the printer was done by Duggie rather than Ted, as the printer was Buncle of Arbroath, who were quite happy to accept decently handwritten copy. Duggie too would have enjoyed the work of finding names for the initials by which members had been identified in the records, and of ferreting out from non-LNHS sources the records of botanists of earlier generations (Hanbury, Wolley-Dod, etc.) which could be included because the people had happened to be members of the LNHS. A by-product of the *Hand List* work was the set of 5 × 8-inch record cards, pre-printed into divisions of appropriate size for each vice-county, all named and numbered in Duggie's hand according to the *List of British vascular plants* by J.E. Dandy, which were used for another forty and more years for entering plant records by Lousley and then by me.

His involvement in the affairs of the BSBI was no less demanding, although slower to develop. In 1950 he was elected to its Council, at that time a three-year term. In 1952 he joined its Publications Committee, and he was to remain on one or other of its committees for very many years. His first set of 'Abstracts from literature' appeared in *Watsonia* in January 1953, following a sort of trial run in *LN* **29** (1950). He continued to produce abstracts for the BSBI until his death forty-six years later, copying details of publications into his notebooks on routine visits to Kew and The Natural History Museum and later at home copying them again into sequence for publication. Duggie edited the 1953 *Year Book* of the BSBI, then every issue of the twice-yearly *Proceedings* which succeeded it until 1966. This too was printed by Buncle, and he was quite happy to proof-read their cheap and antiquated typesetting. The *Year Book* editing job had fallen into his lap because he had taken over at short notice in February 1953 the post of Assistant Secretary; for another ten years in this post he looked after the BSBI's membership list and reported on changes.

In return for his enormous contributions to both societies, what he got from them was a social life. Though he often said little at them, he clearly enjoyed the conviviality of their committee meetings, as later in life he enjoyed the twice-yearly council meetings of The Ray Society. Also he frequently attended field meetings, provided he could get to them, and home again in the evening, by public transport. Always a heavily-built person, on one LNHS meeting in v.c. 18 he fell when negotiating a stile or fence and broke an ankle. On formal occasions such as annual general meetings, and on any occasion which would require him to spend the night away from home, he was less often seen. From the 1950s onwards, it was unusual for him to do any fieldwork in the London area alone, but no other botanist was with him when in 1955 he found *Trifolium fragiferum* on the Coach Mound at Lord's Cricket Ground, a locality he visited many times in his life.

Through the 1950s, Duggie continued to insert new records into the manuscript of his flora, or if necessary rewrite whole pages. As well as abstracts, his notebooks of the time contain data on *Veronica filiformis*, the subject of a joint paper by E.B. Bangerter and D.H.K. in *Proc. BSBI* **2**(3), July 1957, and also on *Senecio squalidus*. He searched the herbaria around London and at Oxford for specimens of this species, and sent questionnaires about it to the curators of other herbaria, and from the results inferred the history of its spread in the British Isles in a series of papers in the *Proceedings* in 1956–64. In the later papers, the herbaria consulted were referred to by initials from a standard set, taken from *British herbaria*, by Kent, Bangerter and Lousley, published in 1958; this was 'an index to the location of herbaria of British vascular plants with biographical references to their collectors', on which, as on so much else, Duggie had been beavering away for years. (After its publication the usefulness of this work became so much more apparent than had been expected that floods of additional data necessitated the publication of a replacement in 1984, *British and Irish herbaria*, by D.H.K. and

D.E. Allen.) In 1957–60 he listed the flowering plants and ferns of 506 walls in Middlesex. His paper publishing the results of this survey in *LN* **40** (1961) looks like a detailed treatment, but it is in fact only a summary of a huge amount of data.

At some time in this period, Duggie and Ivy bought a car and Ivy learnt to drive it, which Duggie never considered. In the mid 1960s, they started using it for holidays. Until then, Duggie had possibly never slept away from home or the Austen house in east Kent. Duggie would arrange for the new issues of journals to be held back for him before shelving in the library at Kew, and they would set off for a week, sometimes two, staying in guest houses. For the first three or four years, when they went as far as Cornwall and the north of Scotland, he made complete holiday plant lists in his notebook, from Ealing to their destination and back, but later, when their destinations were less varied, the plant records, confined to observations of such aliens as *Senecio squalidus* and *Galinsoga parviflora,* took up less space than notes of the cost of petrol, and which of them had paid for it. They went back several times to Llanfair Caereinion in mid Wales, and when Duggie retired Ivy had firmly to squash a notion of moving to Wales.

In his 1959 presidential address to the LNHS, Bangerter referred to a potential new flora of Middlesex 'in the hands of D. H. Kent, whose manuscript, I sincerely hope, will be put into print before too long'. In the event, the manuscript was hardly looked at for a decade, which must have been frustrating for its author, who did not yet know how it might be published.

Twelve of the twenty-seven book reviews Duggie wrote for the BSBI were published in the 1960s. As a sample I would like to quote the review of *Companion to flowers* by David McClintock (1960) which tells us much about both the book and the reviewer: 'Written in the author's inimitable, chatty style I found certain chapters informative, interesting and amusing and some others tedious and irritating . . . *Nardurus maritimus* is referred to as a "dull and insignificant" plant, but it is, in my opinion, when examined carefully with a lens, like *Aira praecox* and *Mibora minima,* a most attractive, diminutive grass . . . The index to the work is excellent and most comprehensive.'

A notice in the *Proceedings* in 1965 announced that 'D. H. Kent . . . is studying the spread of *Bidens frondosa* in Britain and would be grateful for herbarium specimens, fresh material and records', but nothing ever came of it. Just as abortive was a projected cyclostyled *Flora of Ealing,* to be produced by the Borough Library. Only part of the introduction, and text up to Cruciferae, were ever written. A memo from the Librarian dated 20 August 1966 reads 'Dear Mr Kent, four more pages for you to see. Please do not add any more inf. (for 1965 and 1966) as that can be added one day to the revised/new edition . . .'. One can understand how she felt. More successful was the survey of *Calystegia* in the London Area, undertaken by the LNHS on a suggestion made to Kent and Bangerter by C. A. Stace. Starting in 1962, members identified *C. sepium, C. sylvatica* and their hybrid using measurements supplied by Dr Stace, so that their distribution, abundance and habitat preferences could be compared. Although final results were not published until 1967, the success of this attempt at involving LNHS members in a co-operative survey prompted Lousley to introduce the LNHS plant-mapping scheme, which started in 1965. This was one of a number of projects started at about that time which did at a local level, using smaller mapping units, what had recently been achieved nationally by the BSBI's *Atlas of the British flora* (1962). Suddenly the number of records by D. H. Kent mentioned in Lousley's annual compilation in *The London Naturalist,* which had dwindled almost to nothing in the early 1960s, shot up again for a couple of years, as Duggie was driven by the need to cover the whole vice-county for the scheme. He also surveyed many tetrads in other vice-counties and the London Area, mostly as a passenger in Margaret Kennedy's car. For the rest of his life he did very little field work.

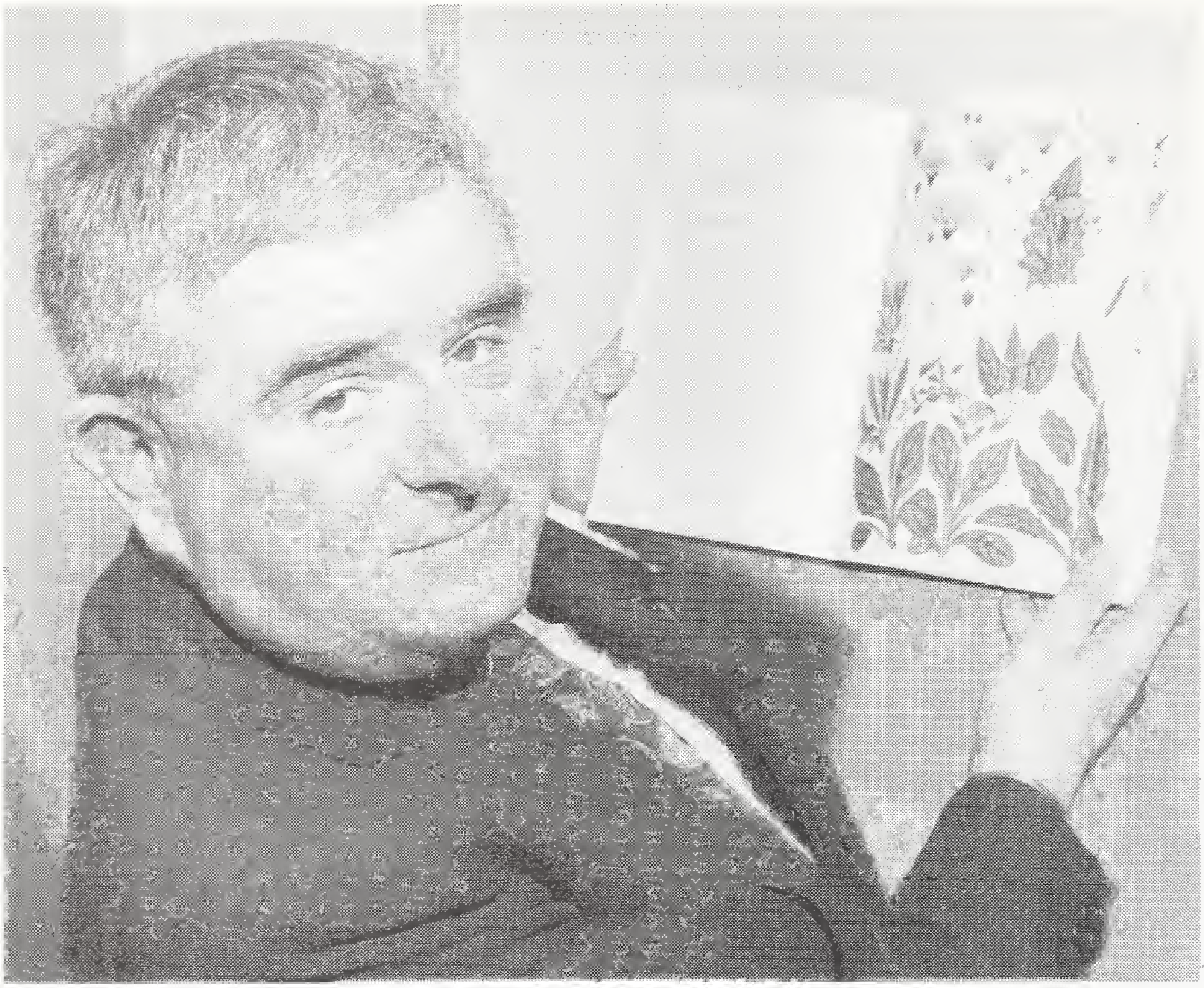

Photo: Roy Kierby, courtesy of North Thames Gas

This is also the period of the photograph of Duggie reproduced here. The book in the picture is *The concise British flora in colour* by W. Keble Martin. Martin was a clergyman who before the Second World War had been one of the two authors of an excellent *Flora of Devon.* Later in life he had produced a comprehensive collection of paintings of British wild flowers which could form the basis of a novel identification book. What was needed was someone who could give the flowers modern scientific names. Duggie agreed to do this for a lump sum, the only wholly commercial undertaking in his botanical life. Published in 1965, with a foreword by Prince Philip, the book was an unexpected best-seller, leaving Duggie regretting that he had not opted for a royalty payment. The book went through several re-impressions, and a new edition in 1982 with the nomenclature substantially revised, again by Duggie.

Duggie's last papers in *The London Naturalist* were the two lots of 'Additions and corrections to the flora of Central London' and 'Notes on some Middlesex grasses', the last published in 1967. That was also the date of his *Index to botanical monographs,* published for the BSBI by Academic Press. This has not achieved the same level of success as his other reference works.

In the 'Vice-County guide' by F. H. Perring in *Watsonia* **8**(4), part of the data for Middlesex was that 'Mr Kent has prepared a MS which will be published by The Ray Society during 1971'. The Ray Society, existing to publish learned books on natural history, had provided the impetus to get the work done, but the estimated date, as so often happens, turned out to be over-optimistic. The author's foreword is dated 'Dec. 1974' and the book was published in the following year. It differs in a number of significant ways from his manuscript of the 1950s, and it seems likely that he had not at first appreciated how much work he was going to have to do reducing the introductory matter by half, adding the bryophytes, etc., and that this was why he suddenly found it necessary to abandon his commitment to the LNHS. Certainly the explanation he gave at the time, that the LNHS was not sufficiently scientific in character, makes no sense.

Many other British county floras had been published since 1950, and the difference in emphasis of Duggie's is well brought out by the title *The historical flora of Middlesex*. No other vice-county has so changed in the period of little over a century since the publication of the previous flora, and his book documents the changes in the flora fully. At the time of publication, the common adverse criticism of it concerned its total lack of a map, which would at least have shown the boundaries of Middlesex, which have been unfamiliar to the public for a very long time. With hindsight, it now seems just as regrettable that most of his own records in the book are not dated; it is not evident that the undated ones were made about thirty years before the date of publication. The comment from readers who were able to accept the book on its own terms was entirely favourable, and it was entirely appropriate that he should receive the Linnean Society's H. H. Bloomer Medal, awarded 'to an amateur naturalist of particular distinction', in 1977.

Shortly after the publication of his *Flora,* Duggie got some way with a list of 'Corrigenda and addenda', and then abandoned it. In the 1990s he started work on a more comprehensive supplement, which he had proof-read at the time of his death. This will be published by The Ray Society about the beginning of the year 2000.

Within a year of the publication of *The historical flora of Middlesex*, Lousley, who had reviewed it for *Watsonia,* died. Duggie's next publications, in the special Lousley memorial issue of that journal in the following year, were a list of Lousley's published works and the description of a new hybrid *Rumex* named after him. This is the only plant new to science described by D.H. Kent, but he was later to be the author of a number of new combinations for plants already known which he found to be incorrectly named according to the *International Code of Botanical Nomenclature*. Duggie in turn is to be the subject of a memorial issue of *Watsonia,* in which a hybrid is to be named after him.

The choice of a *Rumex* to honour Lousley had not been fortuitous. At his death he had left incomplete the text of a BSBI handbook on the dock family, and Duggie was persuaded to complete it; it was found that there was one hybrid which Lousley had collected which had never been given a name of its own. Unfortunately *Docks and knotweeds of the British Isles* was delayed by serious illness which affected Duggie in late 1976, and did not appear until 1981. He got over the worst of this illness, but became a pale shadow of his formerly rubicund self.

In 1983 my own book *Flora of the London Area* was published by the LNHS. I mention this for two reasons. One is to give me the opportunity to say that the letter he wrote acknowledging his complimentary copy showed that he had understood far better than any of the reviewers what it was that I had been trying to do with the material available to me. The other is the hard-bound notebook, which he must have bought for the purpose, and of which he numbered the pages to match those of the *Flora*, so that he could write in additional records in the appropriate place for his own benefit. As he never told anyone about it, and did not maintain it for long, it was an entirely useless, and very typical, thing for him to do.

Duggie still had one major work left in him. Ever since J.E. Dandy's *List of British vascular plants* had been published in 1958, Duggie's abstracting activities had brought to light large numbers of taxonomic and nomenclatural changes, and new discoveries in the British flora also helped to make the 1958 *List* obsolete. In 1985, he started work on a new one, to be published by the

BSBI. At the 1987 BSBI annual exhibition, Stace, who was the subject of a 'profile' by Duggie in *BSBI News* **47** at about the same date, written on the occasion of the younger man's election as President, announced that he was planning to publish a new *Flora of the British Isles,* which would as far as possible contain the same plants, in the same order and with the same names, and come out at the same time, as Duggie's list. In the event the *Flora* treated fully a few alien plants not included in the *List of vascular plants of the British Isles,* one plant only had different names in the two works and the *List* was published several months after the *Flora,* in 1992. In order to achieve this level of uniformity in their works, the two authors had to agree hundreds of decisions, which subspecies to accept, what to do about 'aggregates' of critical species, which aliens to include, etc. The decisions about names were Duggie's. His manuscript (500 pages of it) went not to a printer, but for keying in to what became the core of the BSBI database at Leicester. It was the nearest he ever got to working with a computer, but in fact his mind was very much like a computer, storing up large numbers of small items of information and following through the consequences whenever any one of the items changed. (It also had a computer's capacity for storing error; he wrote *Equisitum* for *Equisetum* in about 1956, and again forty years later.) His text included details of the place of publication of all the names given, which was not included in the printed *List.* He would have liked the work going out over his name to have included these details and also some text giving the justification for some of the choices of names, but this was not regarded as practical.

Needless to say, while working on his *List* he had other irons in the fire. He edited Edees & Newton's *Brambles of the British Isles* (1988), providing a glossary which was singled out for a special word of praise by the reviewer for *Watsonia.* He gave Tim Rich, the author of the BSBI's *Crucifers* handbook (1991), advice on 'momenclature', a printer's error which drew a witty note in *BSBI News* from him. His lifelong interest in the process of record collection using the system of Watsonian vice-counties made him an ideal person to join the working party set up by the BSBI in 1988 to produce a new vice-county census catalogue of the British flora.

In 1993 Duggie received an OBE in the Queen's birthday honours list, an entirely appropriate award for huge amounts of voluntary work, and he looked very well in morning dress, with Ivy at his side. His work was not yet at an end, for there were still abstracts to write and supplements to his *List of vascular plants* and *Historical flora of Middlesex* to prepare. He corresponded at length assisting Rolf Wisskirchen, whose standard list of names for German plants, published with financial support from the federal government, was very like what he would have wished his own *List* to have been.

He was grievously upset by Ivy's death on 7 March 1997, but still continued working. His own death on 9 September 1998, was in hospital during a heart bypass operation. His son Michael had predeceased him in 1988, but he is survived by two granddaughters and a great-granddaughter, Amy Bridge.

Duggie's was a long life and a full one. Although I have been privileged to see many of his notebooks, it would not have been possible to complete this account of it without the help I have received from LNHS members Paul Cornelius, Peter Holland, Keith Hyatt and the late Margaret Kennedy, and from his granddaughter Shelley Bridge. Clive Stace kindly allowed me to see a draft of the obituary prepared by himself and David Allen for *Watsonia* which put me right on several points; I hope their work and mine will be found to complement each other.

RODNEY BURTON

Obituary

HERBERT JOHN FREEMAN, 1911–1998

For the 1970s and 1980s Bert Freeman was one of the stalwart members of the Ornithology Section, who ensured the variety of indoor and outdoor meetings actually took place. His major role was as the Assistant Secretary, in reality the Section's Treasurer. His accountancy background as a former company secretary provided the calm reliability which meant so much to his friends and colleagues. Admittedly, Bert was not slow to express his opinion where he thought necessary; his sense of proportion aided by having spent the war years as a policeman and firewatcher in London. But if Bert wanted his opinion known, it was always worth listening to.

Looking back through the LNHS *Programmes* from 1960, when Bert joined the Society, has shown the good number of local ornithology outings that he lead, plus the coach trips to Chew Valley, Minsmere, etc. Certainly several then new members remember him as an interested and welcoming presence on their first outings. He made the Society approachable and friendly.

Indeed it is as a friend on field meetings that is one of the strongest impressions left to his friends, especially those who accompanied him on his many foreign travels. It was the memory of these that sustained him in his later years.

Our condolences go to his son Philip and daughter Pauline, and to his grandchildren. They have lost more than we have.

MICHAEL WILSDON

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The London Naturalist

Instructions to contributors

Submission of papers

Papers should be submitted **in duplicate** to the editor, Mr K. H. Hyatt at his home address, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU, before the end of January if they are to be considered for publication in the same year. However, the editor may be contacted at any time on 01550 760346 to discuss possible contributions, and will be pleased to send a recent offprint to show our style, and as a guide to preparing the manuscript. Manuscripts **must** be double spaced on one side of the paper only and with wide (3-cm) margins. Authors must retain a copy. Papers should include at the beginning an **abstract, summary** or **synopsis. Sheets must be numbered.** The editor would be pleased to receive contributions as ASCII files on disc (either 3½″ or 5¼″) in IBM-compatible format as well as in manuscript as above. Papers should be relevant to the natural history and archaeology of the London Area. This includes comparisons between London and its surrounding countryside with other localities, as well as work relating to or comparing species or habitats which occur in the London Area.

Text

Locality spellings should follow the latest editions of the maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials, and **only** Latin names of genera and species must be underlined. When both common and Latin names are given there should be no brackets or commas separating them. **Genus names should appear in full where first used within each paragraph.** When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers under 100 should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, month, year, i.e., 25 December 1971, but in lists may be as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs, or St. Lists should be in systematic, alphabetic or numerical order. **Hyphens should not appear at the end of lines** as the right-hand margins of manuscripts do not need to be justified. **Tables and figure legends should be typed on separate sheets at the end of the text. Word-processed text should not use italic, bold or compressed typeface. Paragraphs should be indented. Sentences must not begin with numerals.**

References

Reference citation should be based on the Madison rules (*Bull. Torrey bot. Club* **22:** 130–132 (1895)), except that a colon should always precede a page number. Capitalization in titles of books and papers in journals should be kept to a minimum. Journal titles should be in full, or follow the abbreviations in the *World list of scientific periodicals*, and be underlined. Book titles should also be underlined.

Examples are as follows:

In text:

Meadows (1970:80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964–9. *Lond. Nat.* **49:** 76–81.

MELLANBY, K. 1970. *Pesticides and pollution.* Ed.2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92:** 39–45.

Authors must ensure that all references are cited accurately: they will not be checked by the editor.

Illustrations

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1999

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THE NATURAL HISTORY OF BUCKINGHAM PALACE GARDEN, LONDON. PART 1

Supplement to
The London Naturalist number 78: 1999

Edited by Colin W. Plant

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The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, or rambling, there is a Section ready to help.

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THE NATURAL HISTORY OF BUCKINGHAM PALACE GARDEN, LONDON, PART I

Supplement to THE LONDON NATURALIST

No. 78

for the year 1999

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Introduction to the Survey

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Buckingham Palace Garden represents something unique in Britain. Here, in the heart of one of the most urban areas of Europe, surrounded by traffic and a very large number of people, lie just over 16 hectares (39.6 acres) of greenery which remain largely secluded, other than briefly each summer during the Garden Parties.

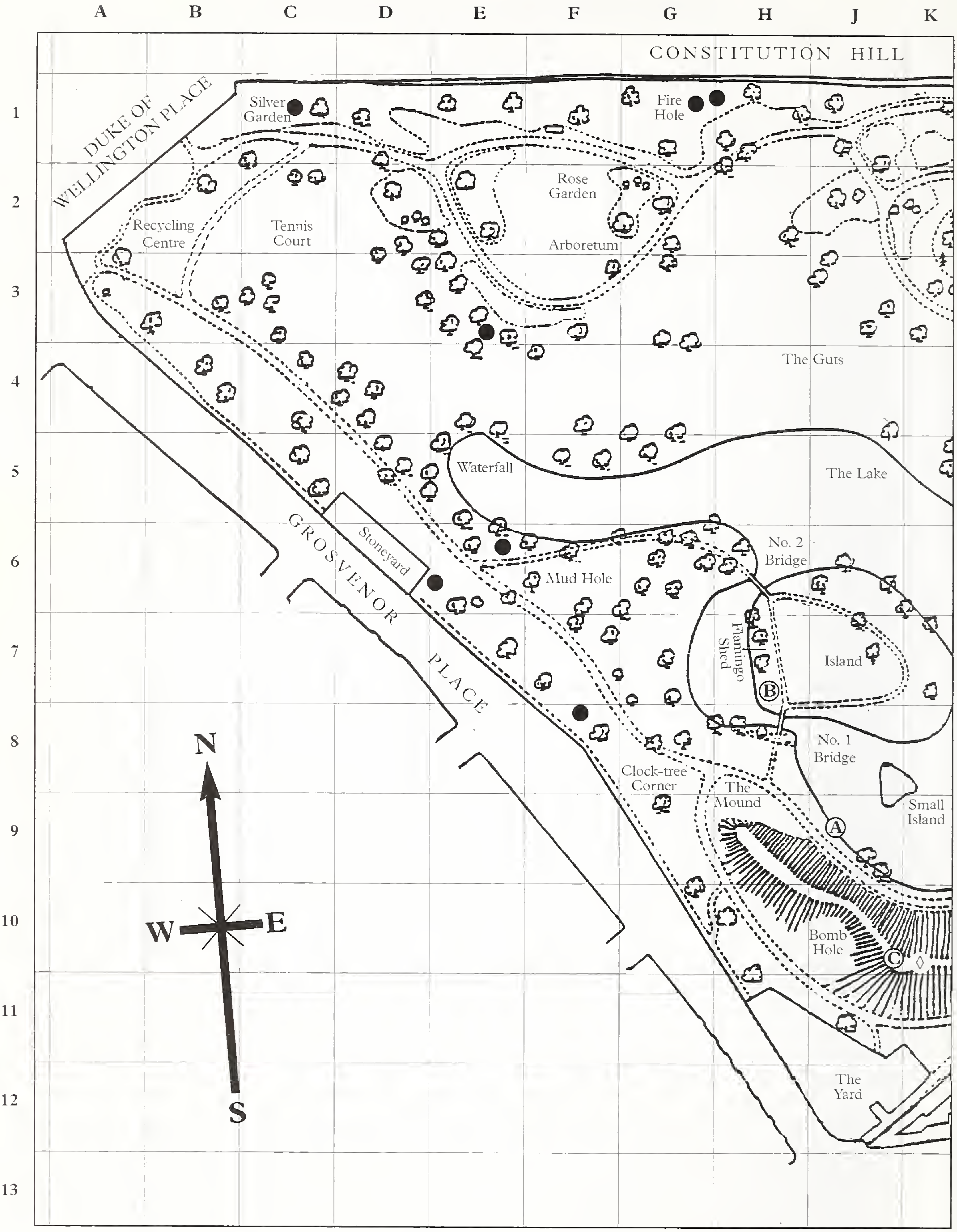
However, in spite of the existence of a London Natural History Society (or at least one of its precursor societies) since as early as 1858, there appears to have been no formal report on any aspect of the flora and fauna in Buckingham Palace Garden until as late as 1926 when, in the spring, F. W. Edwards recorded three species of mosquito (Diptera: Culicidae) breeding in tree rot-holes. Over the next thirty years, casual observations were reported by a small number of visitors to the Palace, but these did little to present any sort of impression of what the flora and fauna might truly comprise.

Yet the present idea of a formal flora and fauna survey at Buckingham Palace Garden is not an entirely new one. During 1956, David McClintock was one of a select party who were allowed access to the Garden to record wild plants. He returned in 1957 for another visit and was given permission to organise recording on a formal basis. Thus, the first survey of Buckingham Palace Garden was initiated in 1960, with most of the field work being carried out from 1961 to 1963.

In the thirty-something years to 1995 that elapsed since that survey was completed and the present one commenced, many changes have taken place — both in the Garden itself and within the surrounding area of the heart of London. There has been a considerable decline in atmospheric pollution from sulphur dioxide. This has been matched by a steady rise in levels of atmospheric pollutants from motor vehicles and other sources. The concept of global warming introduces considerable scope for changes to our flora and fauna — some subtle, some less so, and perhaps enhanced by the 'heat-island effect' whereby the average air temperature in city centres is maintained at a higher level than that of the surrounding rural areas. The steady advance of the urban area has now completely surrounded the green areas that are comprised of the Royal Parks and Buckingham Palace Garden. This must have had a profound effect upon the ability of both animals and plants, even the highly mobile birds, to move freely between the Garden and elsewhere. Within the Garden itself, changes in staff over the years have inevitably led to changes in management regimes and there can be no doubt that the Garden is not the same in 1999 as it was in 1964, when the report of the first survey was published.

Clearly, there was likely to be a considerable scientific benefit in re-examining the site to assess the changes that have taken place and to attempt to explain them. It was, therefore, with some eagerness that the London Natural History Society responded positively to an invitation from Mark Lane, the present Head Gardener at Buckingham Palace, to coordinate a second survey.

This work is the first part of the product of that re-examination, which was undertaken from 1995 to 1997 inclusive, with additional field survey during 1998 and 1999 for some taxa. It will be presented in two parts, the second of which is scheduled for publication in the late autumn of 2001. It is intended to produce the two parts in such a manner that they may have their covers removed and be bound into a single volume should their owners so wish. With this in mind, lists of contents, acknowledgements and other such matter are absent from this first part and will be produced in the next one. However, in this introductory text it is considered important to mention, but briefly, the manner in which the work was organised.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Mud Hole
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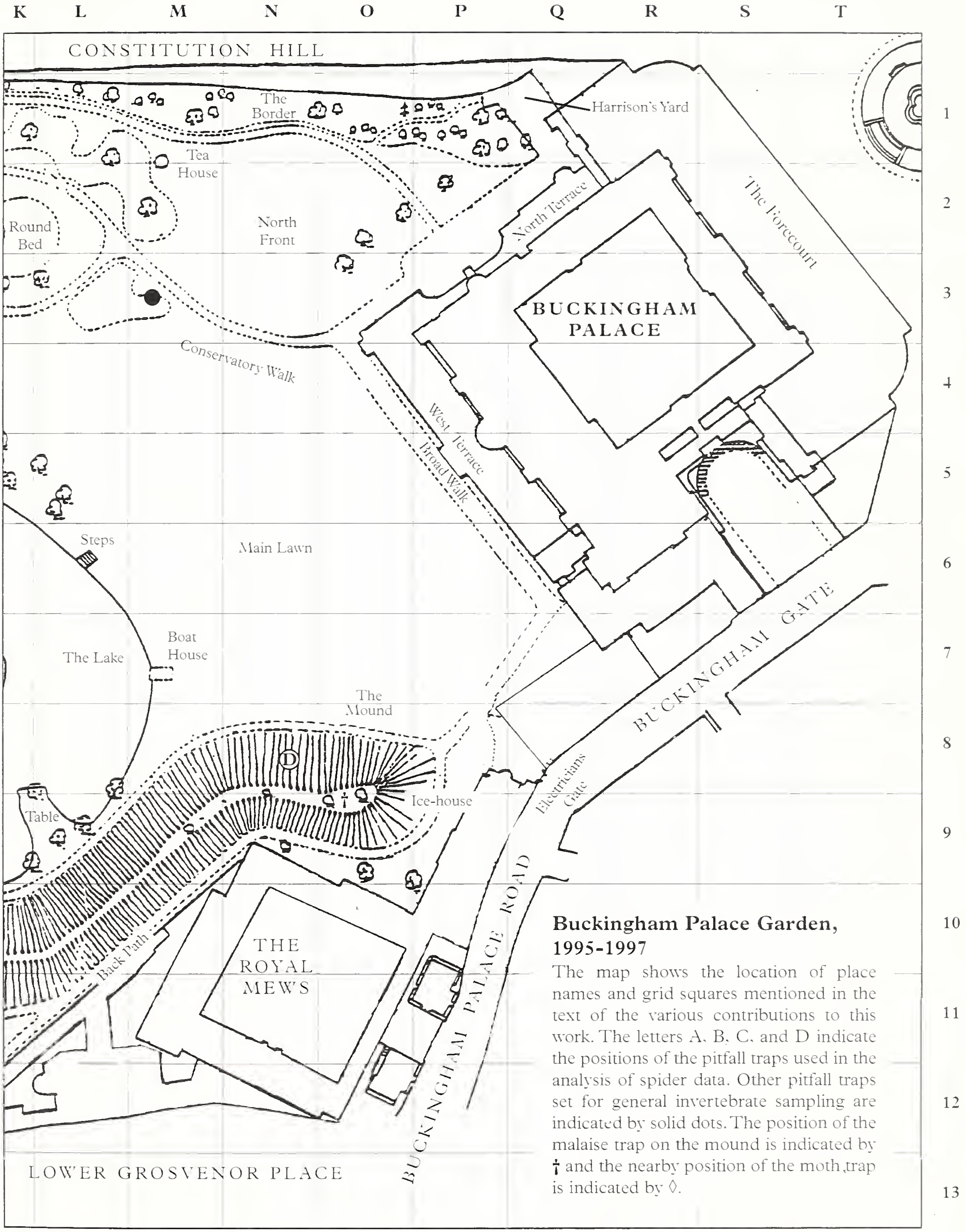

Buckingham Palace Garden, 1995-1997

The map shows the location of place names and grid squares mentioned in the text of the various contributions to this work. The letters A, B, C, and D indicate the positions of the pitfall traps used in the analysis of spider data. Other pitfall traps set for general invertebrate sampling are indicated by solid dots. The position of the malaise trap on the mound is indicated by † and the nearby position of the moth trap is indicated by ◊.

It clearly would have been impractical, if not impolite, to put large numbers of naturalists into what is essentially Her Majesty's private garden. At an early stage, the inevitable committee was established, chaired by the then President of the London Natural History Society, Colin Bowlt, and composed of representatives of the Society as well as The Natural History Museum, Buckingham Palace and other selected specialists. A list of names of potential field surveyors was drawn; these 'core recorders' were most kindly granted access to the Garden. On a day-to-day basis, their activities were coordinated by the Head Gardener, Mark Lane, whilst the data which they gathered were regularly assessed by the steering committee and suggestions made for further work where required. Sometimes, this further work would involve inviting specialists in a particular taxonomic field to spend a day in the Garden. Although the taxonomic coverage is not absolutely complete, the groups for which coverage could not be achieved are very few and relatively insignificant in terms of the overall ecology.

Identification of material collected was undertaken by a veritable army of people, all of whom gave of their time freely to support this important work. These will be acknowledged in Part 2.

Authors have been given a relatively free hand by me in the presentation of their data, although each was charged with producing a paper that would both stand alone and fit in to this overall report and they were asked that it should, where practical, draw comparisons with the first survey, at the same time as presenting a comprehensive set of data that our successors may be able to use in comparison with a third survey. Species lists were required to incorporate all records from all time, so that they could be as complete as possible. As overall editor of the work, it has been my responsibility to see that this actually happens. All the papers which appear in this work have been subjected to peer review and have, in all cases, been returned to authors thereafter for varying degrees of alteration. It is hoped that the end product adheres to the highest possible standard of accuracy but, since it is widely acknowledged in publishing that 'the editor's decision is final', any shortcomings that may become apparent with time must rest squarely on my own shoulders and not on those of others.

Many hours of voluntary work have gone into this report by a very considerable number of people. The results of this complicated labour should be both of interest to the reader and a permanent and accurate record of the natural history of Buckingham Palace Garden at the close of the twentieth century.

Buckingham Palace Garden: geology, history and layout

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Abstract

Buckingham Palace Garden is an area of Central London that has gone through some major transformations during the course of its history and all of these have contributed to the present structure and habitat seen today. A summary of the relevant aspects of the soil and other geological factors, historical aspects, layout and management policies is provided as an introduction to the in-depth papers on specific taxa that follow in this volume. Wildlife habitats currently extant are discussed briefly and it is concluded that the desire to maintain a haven for wildlife has been reconciled admirably with the formal requirements for the Garden.

Geology and soil

The immediately underlying natural geology at Buckingham Palace Garden is one of the geologically recent Thames Terrace Gravels, which overlie London Clay (Plant 1994). The soils of the Garden originally derive from the wet fields that used to cover the area, but have been altered, drained and added to with rubble and soils from a variety of sources over the years, in addition to manuring and mulching. A few soil samples examined during the previous survey (Avery 1964) were of a sandy loam texture containing 13–19 per cent clay but with organic matter ranging between 8 and 16 per cent. Measured acidity varied, even on the lawns, between pH values of 3.5 and 6.4. Peat blocks, used on the edges of some of the flower beds, can be expected to have enhanced acidity in their vicinity.

In the south-east corner, screening the Royal Mews from the Palace, is The Mound, constructed in the mid 1820s from imported London building debris and covered with a sandy loam, and now incorporating fine examples of fabricated stone (Pulhamite) outcrops. These, and similar stone-work on the two bridges to the island, brick-pointing and other cement-work, together with the Portland Stone of the Palace itself, provide some of the limited alkaline situations.

History

Until well into the sixteenth century, the Palace site and the surrounding areas were swampy, being watered, and quite often flooded, by the Tyburn River. This ran from Hyde Park Corner across the east front and the south wing of the present Palace. Lord Arlington put the Tyburn into a conduit, but the area was not finally drained until 1824. Up to the end of the eighteenth century this land was open country. It was divided into areas with such names as Adam's Pasture, Upper and Lower Crow Fields, Goring Great Garden and Mulberry Garden Field, with smaller fields in between. Early in the eighteenth Century some of these fields were amalgamated into the grounds of Buckingham House.

In 1608/9, King James I had his Mulberry Garden planted on no less than four acres to the north of the present Palace in an attempt to foster the cultivation of silk worms, which had been successful on the Continent. This expensive and troubled project was, for various reasons, a failure.

In 1677, it was reported that there was a flower garden, dwarf tree garden, wilderness grove, bowling green, very extensive orange houses, also a terrace walk and a mount set with trees, a kitchen garden and a pond. Sir John Sheffield, later the Duke of Buckingham, bought the site in 1702. Changes to the Gardens were designed by Henry Wise (1653–1738), of London and Wise, based in Brompton. Something like £1,000 was spent on levelling the ground and a further £1,000 on plants by the end of 1702. In 1709, Buckingham wrote a long description of the Gardens, mentioning various plantings and features including a long tree-lined canal.

All this time there seems not to have been any considerable fence around the Garden, but a lease of 1716 refers to a fence and one in 1745 to a wall. There is a reference in 1746 to the park wall to Buckingham House and an engraving after Chatelain of 1748 shows an unmistakable line of railings, with which grew a boundary of trees round the garden. In maps of 1761 and 1818, there appears an oval pond some sixty by twenty feet, situated towards the western boundary, with a much smaller one just to the north, but these were gone by 1821. In 1817, the garden was described as consisting merely of a gravel walk shaded by trees with a spacious and unadorned area in the centre.

King George IV commissioned William Townsend Aiton to landscape the Garden and he was still working at it when Queen Victoria came to the throne in 1837. In fact he held the contract for maintenance and replanting from 1826 until 1838. Nash offered Aiton's preliminary estimate for the laying out of the Garden in 1825 at £22,290 although there is no record whether this was accepted. Again in the same year, there had been a Supplementary Estimate that included the 'earthworks in the garden'. By 1827/8, the lake had been excavated and The Mound (see map, pages 2–3) constructed, being planted with trees and shrubs in great quantity. The mound was primarily made to conceal from the windows of the Palace the view of the recently erected stables. Some of the excavations from the lake might well have gone into forming The Mound, but although they cover a similar area, The Mound is substantially higher than the lake is deep confirming the importation of soil. Planting went on vigorously until at least 1838, and indeed has continued, intermittently, ever since. A Small Mound was constructed in 1860 at the behest of Prince Albert so as to protect the Queen from being overlooked from the then new Palace Hotel.

Soil and other materials have been imported on numerous other occasions. In 1833, the purchase of 500 cubic yards of gravel from Hyde Park was authorized, for an unstated purpose; the inference is that another 2,000–3,000 cubic yards came in the following year. In 1841, 150 cubic yards came from Shirley Common, some from Norwood and 300 cubic yards from Kensington Gardens — 'for the border'. In the winter of 1905, 1,500 cubic yards of soil excavated from the Queen Victoria Memorial were used to top dress the lawns and the King agreed that it should be carried out, even though it might disfigure them for a while. When the Cascade was built in 1961, 5,000 turves came from Essex and 2,500 cubic yards of soil came from Hyde Park, as well as topsoil from Kent.

In 1840, the Garden consisted of a spacious lawn and groups of trees 'many of great magnitude especially elms', pre-dating Aiton's plantings. At much the same time, the Queen referred to 'limes and their shade'. However, a report in the same year stated 'these gardens are destitute of the customary appearance of a flower garden'. Consequently, proposals were made for beds to be filled with plants that flower at different times. In December 1840, Prince Albert arranged for a gravel walk to be made along the top of The Mound with connecting walks in different directions, as well as 'across the island and the headland on the north side of the island', about 1,000 metres (1,100 yards) in all. These no longer exist, having been turfed over.

Layout

William Townsend Aiton's original layout is still very much in evidence. Little has changed to the overall designs of the paths, mound, lake or grass areas since 1825.

His, and subsequent, plantings of London plane have matured and become the dominant trees in the Garden. The numerous, aged, holly bushes and the later plantings of camellias and rhododendrons, provide a good amount of evergreen cover. Some changes have taken place, probably the most notable being the loss of a great number of elm trees and the demolition of the Small Mound.

The Garden maintains an open and rather park-like appearance, due mostly to their size and maturity. Large and flourishing shrub borders are strategically placed to obscure corners and to invite investigation. Striking vistas can give the impression of being in the country as well as making the Garden appear even larger. The Garden is screened from the outside by many mature trees; London plane, sycamore, common ash, false acacia and oaks which filter the noise and pollution of the surrounding busy roads.

The area of the Garden is 16.015 hectares (39.57 acres). The greater part is made up of mown lawn, notably the Main Lawn, at about two hectares (4.95 acres), extending from the West Terrace to The Lake and used up to six times a year for the Garden Parties. It is also acts as a landing pad for helicopters. Another considerable stretch of lawn extends through the centre of the Garden towards the Tennis Court and beyond.

The Garden is mostly level, but rapidly rises 7.5 metres from the tennis court towards the north end, corresponding to the rise in Constitution Hill and Grosvenor Place. The stout walls, surmounted by *chevaux-de-frise*, are almost unseen from the inside, where the soft landscaping has all but hidden its stark appearance.

There is no natural water. The sinuous, man-made lake of 1.56 hectares (3.86 acres), with a depth of no more than 1.5 metres, lies towards the south-east of the Garden. It incorporates a recently installed waterfall (1991) that recirculates the water. Two bridges connect the larger island in the lake. To the south side is another smaller island.

The Mound, some 8.6 metres at its highest point, runs along the south of the Garden. It serves well its original purpose of hiding the view of the Royal Mews from the Palace. At its eastern extremity is a large, long-disused Ice House.

Habitats

A high-flying bird would see that Buckingham Palace Gardens, together with Green Park, from which it is separated by the tree-lined Constitution Hill, form part of a chain of large parks, separated only by roads. This green expanse stretches from Kensington Gardens in the north-west to St James's Park in the south-east. Buckingham Palace Garden differs in being hidden behind a high, brick wall and therefore not subject to disturbance and pressure from the public.

The composition of the Garden provides a mixed and varied selection of habitats. The large, wide shrub borders can be regarded as a domesticated form of scrub habitat. These are made up of rhododendrons, camellias and azaleas with occasional plantings of birch, ornamental apple and non-native species, providing suitable nesting-sites and safe cover for birds, mice and other creatures.

The Lake accommodates the captive bird collection and the seasonal migrants, as well as a wealth of aquatic animal life. Water movement from the waterfall is slow, but the quality is sufficiently good to support several species of fish, though submerged aquatic plants are very limited. The soft, wet edges and associated vegetation provide a variety of habitats for invertebrates and some bird species.

Within the larger habitats occur micro-habitats, just sufficient in size to provide for the needs of small organisms. For example, bark from the Palace trees, including planes, were found to support certain myxomycetes, and some small species of fungi were growing on fallen nuts, acorns and leaves. The requirements of many small invertebrates, mosses, etc., are relatively simple, provided that the climate (including air quality) is acceptable. Such micro-habitats often depend, of course, on the larger habitats. An example of this was a single record of the moss *Dicranoweisia cirrata* found growing on an old weeping willow *Salix* x *sepulchralis* var. *chrysochoma*. When the tree was felled, the moss became extinct in the Gardens. This is an example of the vulnerability of small populations.

The average temperatures in central London are slightly higher than in surrounding rural areas. Over a long period, the average temperature at Kew, Surrey was 10.2°C, whilst at St James's Park, adjoining Buckingham Palace, it was 10.7°C (Kent 1975). The difference between central London and the continually built-up area averages about 1.5°C (Burton 1983). This reduces somewhat the risk of frost damage. The rainfall is measured daily in the Garden, but does not differ significantly from the rest of central London.

Management policies

The vigorous activities of the gardeners have many effects and increased mechanization (since the last survey, from 1961 to 1963), has speeded up the various aspects of garden maintenance, with compact tractors and trailers replacing brome trucks.

There are currently two regimes for the grassland management in the Garden; the wilder areas are cut only twice a year and the more ornamental lawns are cut weekly throughout the growing season. The first provides home to many wild plants and naturalized bulbs and the second a perfect home for the famous chamomile *Chamaemelum nobile.*

The general policy in the Gardens is to use the minimum quantity and variety of chemicals necessary and to maintain full records of usage. There is localised spraying for greenfly, black spot and mildew in the Rose Garden and some control for slugs on The Border. Weed growth can be a problem in gravel paths and so these are sprayed when necessary. Weeds elsewhere are dealt with manually. Fertilizers are used only on the ornamental lawns and shrubberies.

All of the annual leaf-fall, as well as the grass clippings, are collected and transported to the Recycling Centre within the Garden for composting. All branches and small logs are chipped and disposed of in the same way. This composted material is then used around the Garden as mulch on the shrub borders. This is a relatively recent change to the waste management regime. Before 1991, all green waste was sent out of the Garden and very little mulching was done in the borders. Well-rotted farmyard manure is brought in annually to mulch the roses and magnolias and occasionally other mulches are imported for specific tasks, such as ornamental bark for woodland footpaths.

It would not be possible to sustain the plantings if irrigation was not used and the borders and some grass areas are regularly irrigated during the drier months. This provides some small, artificially wet areas and sites.

Conclusions

Despite all the varied artificial factors which have been at work for so long in the Garden, the ecological successions, food-chains and all the natural cause-and-effect in the wild are always striving to assert themselves. But for the extremely active gardening, the place would soon revert to an even richer haven for wildlife, but this is not generally compatible with the requirements of the Garden. Fortunately, the two opposing factors are well reconciled.

References

AVERY, B.W. 1964. A note on the soil. *In* McClintock, D.C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. Trans. S. Lond. Ent. Nat. Hist. Soc.* 1963: 13.

PLANT, C.W. 1994. A map of the surface geology of the London Area. *Lond. Nat.* **73**: 215-220 plus map.

Myxomycetes in Buckingham Palace Garden

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Abstract

Sixty-eight species of slime moulds have been recorded from Buckingham Palace Garden, thirty-three from the bark of living trees, notably *Platanus*. Several of these are rare species and represent new records for the London Area.

Introduction

Ornamental Gardens in the centre of major cities are, at first sight, unlikely habitats for the plasmodial slime moulds, or Myxomycetes. The first survey of Buckingham Palace Garden (McClintock 1964), revealed a single, very common species, *Fuligo septica*. During the current survey, myxomycetes were collected in the field during regular visits, usually weekly, by Peter Holland and Alick Henrici, while recording 'true' fungi. A single visit in January 1997 by the writer enabled the collection of twenty-eight bark samples from twenty-four species of tree in the Garden. These were subsequently cultured in moist chambers and produced thirty-three species of myxomycete and one acrasian, *Pocheina rosea*. Most of these species are typically inhabitants of the bark of living trees, corticoles, but a few are more usually found on rotten wood and in leaf litter — casual spores may have taken advantage of the culture conditions to develop and fruit.

A total of sixty-eight species of slime moulds is now recorded (a gain of sixty-seven species, with no losses). This compares well with the 356 species recorded from the British Isles. Considering the limited range of micro-habitats available, notably the scarcity of stumps, rotting trunks and large fallen branches, it is unlikely that this number will be increased significantly. The list is surprisingly large and, in addition, includes some nationally very rare species. Of these *Comatricha ellae* was the third record from England, *Licea pygmaea* had not previously been found in the south of England and *Paradiacheopsis microcarpa* was hitherto known only from north Wales and Cheshire. *Licea biforis* is a species which appears to be extending its range in Britain and is now common in the London Area. As well as on tree bark, it is also recorded from the Garden, on old herbaceous stems maintained in a moist chamber. This is a new habitat for the species. *L. operculata* is becoming of frequent occurrence and is now known from other parts of central London (Ing 1998). *L. scyphoides* is more usually found in Atlantic woodland, but is known from Sussex and, since the Survey, from Holland Park, London. *L. tenera* is a rare and misunderstood species, with few records anywhere, although it was recorded from Epping Forest in 1898. Of the bark species, seventeen are new published records for the London area. In contrast, those Myxomycetes found on wood and herbaceous litter are all common species, characteristic of woodland and grassland throughout southern Britain.

The interest of the list is achieved partly by a sustained collecting effort and partly by the use of specialized techniques, such as moist chamber culture. The range of habitats present allows species characteristic of woodland, grassland and cultivated land to find suitable niches. The wide range of tree species is of greater significance, notably the presence of large specimens of London plane, *Platanus × hispanica*. Before this survey, plane bark was not considered to be particularly productive. In the Garden, sixteen species developed on the bark of London plane, more than twice the number on any other genus of trees. A similar result has been shown in many central London parks (Ing 1998).

The situation of the Garden, surrounded by busy roads and a densely populated city, is not promising. The abundance of Myxomycetes, although they are not known to be especially sensitive, suggests that pollution levels are dropping significantly. The high perimeter walls may well be reducing the impact of pollution from road traffic. Above all, the abundance of roosting birds may be linked to the enrichment of the bark with nitrogenous bases from their droppings and the consequent neutralising of acid deposition. The management of the Garden is maintaining and increasing the diversity of micro-habitats. The value of non-native trees as substrates for bark Myxomycetes is well shown, in that twenty species were found on native trees and twenty-nine on exotics.

List of Myxomycota recorded in Buckingham Palace Garden

The nomenclature in this list, and the arrangement of the species, follows Ing (1999). The single species recorded in both the previous and the present surveys is indicated by an asterisk (*). Herbarium material is held in Herb. P.C. Holland and in Herb. B. Ing; all these voucher specimens are destined to be deposited in Herb. Kew. VC 21 means Vice-county 21, Middlesex.

MYXOMYCOTA

ACRASIOMYCETES

ACRASIDALES

Acrasidaceae

Pocheina rosea (Cienk.)Loeblich & Tappin

On bark of *Castanea*, *Pinus* and *Populus*. This acrasian is usually the first slime mould to appear when bark is placed in moist chamber culture, often after 24 hours. It is characteristic of the most naturally acid, or acidified bark, but is not persistent so may be overlooked in cultures if they are not examined daily. It is widespread on urban bark.

MYXOMYCETES

ECHINOSTELIALES

Echinosteliaceae

Echinostelium apitectum Whitney

On bark of *Pinus* and *Robinia*. A widespread and frequent species, similar to and sometimes confused with *E. colliculosum*. This is a new record for Inner London and VC 21.

E. brooksii Whitney

On bark of *Aesculus*. A widespread and frequent species on isolated, rather acid-barked trees, not common within forests but very characteristic of park trees. New to Inner London and VC 21.

E. colliculosum Whitney & Keller

On bark of *Platanus*, *Populus*, *Quercus* and *Salix*. Another common and widespread species, although it may be confused with *E. apitectum*, characteristic of moister bark, which is often less acid than that tolerated by other species. New to Inner London and VC 21.

E. corynophorum Whitney

On bark of *Acer*, *Eucalyptus*, *Quercus* and *Taxus*. A widespread and but less common species, frequent on eucalypts. New to Inner London and VC 21.

E. fragile Nann.-Bremek.

On bark of *Platanus*, *Robinia* and *Salix*. Frequent and widespread, especially on isolated trees, perhaps with less-acid bark than those favoured by *E. brooksii*.

E. minutum de Bary

On bark of *Aesculus*, *Fraxinus*, *Platanus* and *Taxus* and on fallen *Rhododendron* leaf. Common and widespread, not showing any tree preferences and occasionally, as here, developing on litter; usually develops later in culture than other species of the genus.

LICEALES

Liceaceae

Licea biforis Morgan

On bark of *Platanus* and *Salix* and on dead stems of *Eupatorium*. Frequent and widespread in southern and western Britain, but until now not associated with urban trees. New to Inner London.

L. denudescens Keller & Brooks
On bark of *Aesculus*. A frequent but inconspicuous species characterised by the deciduous outer layer of the sporangium wall: mostly associated with lichens on bark but may also occur, as here, with the green alga *Desmococcus olivaceus*. New to inner London and VC 21.

L. kleistobolus Martin
On bark of *Aesculus*, *Crataegus*, *Malus*, *Pinus*, *Platanus*, *Populus*, *Quercus*, *Salix* and *Taxus*. Another common and widespread species, typical of thin, acid bark, especially of conifers and often found on quite young trees, shrubs and climbers. New to inner London.

L. marginata Nann.-Bremek.
On bark of *Castanea*, *Fraxinus* and *Platanus*. Widespread but not common, although when it does occur it may be in such numbers as to completely cover the surface of the bark, as is the case with the material from the Garden. Usually found on moisture retentive, less-acid, bark. New to Inner London.

L. minima Fr.
On bark of *Salix*. A common and widespread species on acid bark and also on rotten wood of conifers.

L. operculata (Wingate)Martin
On bark of *Platanus* and *Salix*. Frequent in eastern Britain, usually on thick-barked trees, especially if the bark is eutrophicated with bird droppings. New to Inner London and VC 21, but since the survey found to be widespread in central London.

L. parasitica (Zukal)Martin
On bark of *Fraxinus*, *Platanus*, *Salix* and *Sophora*. The commonest species on bark, especially if it is moisture-retentive, often associated with mosses and lichens and perhaps less abundant on acid bark. New to Inner London and VC 21.

L. pygmaea (Meylan)B. Ing
On bark of *Platanus*. A rare species on very mature bark: not previously recorded from the south of England but since found in five other parks in central London.

L. scyphoides Keller & Brooks
On bark of *Salix*. A typically Atlantic species, rare in south-east England. New to Inner London and VC 21 but subsequently found in Holland Park.

L. tenera Jahn
On bark of *Taxus*. A rare and misunderstood species, sometimes reported from dung, and then probably a misidentification for a species of *Perichaena*. This is a true bark species and is known from Surrey and Epping Forest but is new to Inner London and VC 21.

L. testudinacea Nann.-Bremek.
On bark of *Platanus*. Widespread but uncommon, usually on thicker, more eutrophic bark than the superficially similar *L. minima*. New to Inner London and VC 21.

Dictydiaethaliaceae

Dictydiaethalium plumbeum (Schum.)Rostaf.
On fallen twigs and branches of *Fraxinus* and *Prunus*. A common and widespread species on fallen wood, especially in the south of England.

Lycogalaceae

Enteridium lycoperdon (Bull.)Farr
On stump of *Sorbus latifolia*. One of the commonest Myxomycetes, especially in spring on dead, standing trees, and often on worked wood in buildings.

Lycogala terrestre Fr.
On stump of *Sorbus latifolia*. The commoner segregate from the *L. epidendrum* complex, very common everywhere on fallen trunks, branches and stumps.

TRICHIALES

Dianemataceae

Calomyxa metallica (Berk.)Nieuwland
On bark of *Crataegus* and on rotten wood. Widespread and frequent, now known to occur widely on *Platanus* in London parks.

Arcyriaceae

Arcyria affinis Rostaf.
On rotten stump. Frequent in southern England, especially on *Fagus*.

A. cinerea (Bull.)Pers.
On bark of *Platanus*, *Robinia* and *Taxus*. A common and widespread species on moist bark and fallen wood, often associated with bryophytes.

A. denudata (L.)Wettst.
On rotten wood. Very common on fallen trunks and stumps, especially of hardwoods.

A. incarnata (Pers.)Pers.
On rotten *Salix* stump. Common everywhere, especially characteristic of fallen *Quercus* branches.

A. pomiformis (Leers)Rostaf.
On bark of *Crataegus*, *Malus*, *Platanus* and *Taxus*. Common and widespread on bark, often drier and more acidic than that supporting *A. cinerea*, also found on fallen branches, but not associated with bryophytes.

Perichaena chrysosperma (Currey)Lister
On bark of *Platanus*. A widespread and frequent species on damp, eutrophic bark in western and northern Britain, much rarer in the south. New to Inner London.

P. depressa Libert
On bark of *Platanus*. Widespread in southern Britain and common on fallen bark, especially of *Fraxinus*, but very uncommon in moist chamber culture. New to Inner London.

P. vermicularis (Schw.)Rostaf.
On fallen *Ilex* twig. An uncommon species of deep leaf litter, especially during the winter months. New to Inner London and VC 21.

Trichiaceae

Metatrichia floriformis (Schw.)Nann.-Bremek.
On rotten wood. One of the commonest species on wet, rotten wood, mostly in secondary woodland, although at the beginning of the century it was regarded as a rarity.

Trichia contorta (Ditm.)Rostaf.
On fallen *Fagus* cupules. A frequent, but variable species on twigs and woody litter, widespread in the London area.

T. flavicoma (Lister)B. Ing
On fallen *Fagus* cupules. An uncommon species of leaf litter. New to VC 21.

T. varia (Pers.)Pers.
On rotten wood. Very common on wet, rotten wood everywhere.

STEMONITALES

Stemonitaceae

Comatricha alta Preuss
On fallen *Betula* trunk. An uncommon species in the London area, as elsewhere.

C. ellae Härkönen
On bark of *Populus*. A rare species, sometimes mistaken for small forms of *C. nigra* which occur on bark. This is the third record from England and the fourth from the United Kingdom. New to VC 21.

C. laxa Rostaf.
On bark of *Quercus* and *Tilia*. A common and widespread species on fallen wood, much less frequent on bark. New to Inner London and VC 21, but subsequently found in three more London parks.

C. nigra (Pers.)Schroet.
On rotten branch of *Sorbus*, and bark of *Pinus*. One of the commonest Myxomycetes anywhere on rotten wood but much less common on bark, although found regularly on that of conifers in mountain woodland!

C. rigidireta Nann.-Bremek.
On bark of *Aesculus*. A rare species which seems to be commoner in central London than in any other part of the British Isles. The Buckingham Palace Garden collection was a new record for Inner London and VC 21, but it has now been found in several other parks around the city.

Enerthenema papillatum (Pers.)Rost.
On fallen branch of *Sorbus*. This is usually a common species on the bark of trees such as *Quercus* and *Pinus*, but it is surprisingly rare in this habitat in the London area, although common on fallen branches.

Lamproderma scintillans (Berk.& Br.)Morgan
In leaf litter. One of the commoner species of this beautiful genus and very characteristic of *Ilex* litter in the London area.

Paradiacheopsis cribrata Nann.-Bremek.
On bark of *Quercus*. Widespread on bark, but less common than *P. fimbriata* or *P. solitaria*. New to Inner London and VC 21.

P. fimbriata (G. Lister & Cran.)Hertel
On bark of *Acer*, *Aesculus*, *Castanea*, *Fraxinus*, *Pinus*, *Platanus*, *Populus*, *Quercus*, *Robinia*, *Salix*, *Sophora* and *Tilia*. The commonest myxomycete on naturally acid or acidified bark and generally abundant on the bark of urban trees, often to the exclusion of all other species; often associated with green algae and lichens.

P. microcarpa (Meylan D.W. Mitchell
On bark of *Pinus*. A rare species of acid bark, hitherto known only from north Wales and Cheshire and, so far, confined to *Pinus* or *Quercus*. New to VC 21.

P. solitaria (Nann.-Bremek.)Nann.-Bremek.
On bark of *Acer*, *Castanea*, *Populus*, *Quercus* and *Tilia*. Common and widespread but usually associated with older woodland in less acid or unpolluted areas. It is one of the species characteristic of ancient forest but is clearly not exclusive. Its presence in the Garden, as in other parts of central London, is an indication of the improvement in air quality in recent years.

Stemonitis axifera (Bull.)Macbr.
On rotten wood. A common and widespread species.

S. fusca Roth
On dead wood. The commonest species of the genus.

Stemonitopsis typhina (Wiggers)Nann.-Bremek.
On stump of *Platanus*. One of the more common species of wet, very rotten wood, especially of broad-leaved trees.

PHYSARALES

Physaraceae

Badhamia foliicola Lister
On bark of *Aesculus*. A species found in three distinct habitats, namely living lawn grasses, grass litter and bark of living trees. It is frequent in all three habitats in the London area.

B. panicea (Fr.)Rostaf.
On rotten stump of *Sorbus latifolia*. Common and widespread, especially on fallen *Fagus* trunks.

B. utricularis (Bull.)Berk.
On *Stereum* on fallen branches. The large yellow plasmodia of this common species are a familiar sight on fruit-bodies of *Stereum* and *Phlebia*, especially on *Fagus* trunks; this is one of the few truly fungivorous species.

Craterium minutum (Leers)Fr.
In litter of *Platanus*, *Pteridium* and grasses. A common species on herbaceous litter, occasionally fruiting on living leaf stalks, especially of *Ranunculus repens*.

Fuligo rufa Pers.
On well-rotted stump. Characteristic of very rotten stumps. Often in places which are exposed to the sun and therefore warmer and drier. Recorded several times around London, but new to VC 21.

**F. septica* (L.)Wiggers var. *flava* (Pers.)R.E.Fr.
On rotten stumps of *Sorbus* and *Platanus*. The very common 'Flowers of Tan' which is, perhaps, the most familiar myxomycete to non-specialists, often looking like scrambled eggs spilt onto a log or stump.

Physarum bitectum G. Lister
In leaf litter. Common in the London area on leaf litter of all kinds, becoming rarer northwards.

P. bivalve Fr.
In moss at the bases of grass clumps. Another common litter species; occasionally fruits directly on the soil or, as here, on mosses and other living plants.

P. cinereum (Batsch)Pers.
On grass and leaf litter. One of the species which is often reported as a 'lawn pest' as its yellow plasmodia and purple-grey sporangia 'look sinister'. It is widespread in the London area and is, of course, harmless.

P. compressum Alb. & Schw.
On bark of *Castanea*. Normally a species occurring in herbaceous waste, such as compost heaps, but not uncommon on bark after several weeks of culture. New to Inner London.

P. pusillum (Berk.& Curt.)G.Lister
On grass litter. Another species with a variety of regular habitats, mostly grass-based, this is found in sand dunes, reed marshes, straw heaps and thatch and also on the bark of living trees.

P. robustum (Lister)Nann.-Bremek.
On fallen branch of *Sorbus aucuparia*. A common and widespread segregate from the very common *P. nutans*, this is a new record for Inner London.

Didymiaceae

Diderma hemisphaericum (Bull.)Hornem.
In damp leaf litter. Characteristic of leaf litter in alder carr and other wet woodlands, this species is quite common in the London area.

Didymium bahiense Gottsberger
In grass litter. This is the commonest segregate from the *D. iridis* complex, found in many types of herbaceous litter. It is common in the London area.

D. clavus (Alb.& Schw.)Rabenh.
On bark of *Platanus*. A widespread and frequent species of forest litter, rarely found in bark cultures, and then only on enriched bark after several weeks. As with many of these 'casual' corticolous species the spores were probably trapped on the bark and were stimulated into growth by the conditions in the moist chamber. While not truly 'bark' species they are part of the local myxobiota and therefore the technique is useful in isolating them.

D. difforme (Pers.)S.F. Gray
In litter of *Eupatorium* and *Ilex*. One of the commonest species on litter of all kinds.

D. megalosporum Berk. & Curt.
In damp herbaceous litter and fallen *Fagus* cupules. Another segregate of *D. iridis*, often found on dung as well as litter; frequent in the London area.

D. melanospermum (Pers.)Macbr.
On fallen *Fagus* cupules. A common species of litter, especially of coniferous needles, but also typical of *Ilex* litter and found on a variety of terrestrial mosses.

D. squamulosum (Alb.& Schw.)Fr.
In grass and leaf litter. One of the commonest litter species, abundant everywhere, especially in the winter months.

Mucilago crustacea Wiggers
Encrusting grass stems. A large species, characteristic of base-rich grassland, common in the London area.

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References

ING, B. 1998. Corticolous myxomycetes from central London. *Lond. Nat.* **77**: 83–89.
ING, B. 1999. *The Myxomycetes of Britain and Ireland.* Richmond Publishing, Slough.
McCLINTOCK, D. 1964. Bryophytes and fungi. In: McClintock, D. C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963: 36-38.

Lichens (lichen-forming fungi) in Buckingham Palace Garden

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Abstract

Thirty-nine species of lichen-forming fungi are reported from Buckingham Palace Garden: two were reported in a previous survey published in 1964. Of these, seventeen occurred on trees, including several which are particularly sensitive to air pollution by sulphur dioxide (e.g., *Evernia prunastri, Parmelia caperata, P. subaurifera, Ramalina farinacea*). The species now found are consistent with what would be expected from changes in the ambient levels of this pollutant; its mean winter levels have declined from 450 $\mu g\ m^{-3}$ in 1962 to less than 50 $\mu g\ m^{-3}$ in 1987, and are perhaps now close to 30 $\mu g\ m^{-3}$. Several interesting species were also discovered on walls and other built structures (e.g., *Caloplaca decipiens, Physcia dubia, Xanthoria elegans*). Further improvements can be expected provided that sulphur dioxide levels remain at current levels or decrease further.

Introduction

Lichens are a biological and not a systematic group, being mutualistic associations between a fungus and an alga, cyanobacterium, or both. The names applied to lichens are strictly those of the fungal component; the included algae or cyanobacteria have independent scientific names. The classification of lichen-forming fungi is now fully integrated with that of the non-lichenized fungi. The fungi involved are mainly *Ascomycota,* but belong to a variety of orders, many of which include non-lichenized as well as lichen-forming fungi.

It is increasingly common practice for lichenized fungi to be listed with their non-lichenized relatives in species lists. They are treated in a separate contribution here primarily because of the remarkable changes that have taken place in these fungi in Buckingham Palace Garden since the last survey.

For further information on the identification of lichen-forming fungi see Purvis et al. (1992) and on their biology and nature see Hawksworth (1988) and Nash (1996).

This report is based on visits made to Buckingham Palace Garden on 6 December 1995, 7 March 1996, 19 November 1996, 13 March 1997, and 6 March 1998. Different areas of the Garden were examined and good coverage obtained. Surveys were undertaken using a ×10 hand lens and small samples of critical specimens collected for confirmation chemically and/or microscopically. In the case of species on the fabric of buildings and monuments, microscope slides were made in the field for subsequent study. The only areas not studied in detail were the tops of the high-security boundary wall and the roofs of buildings (including the Palace itself). All the mature trees, most of which are individually numbered, were examined and the most interesting revisited on several occasions.

Thirty-nine lichen-forming fungi were discovered during 1995 to 1998. This may seem a small number compared with the 1,653 currently known in Great Britain and Ireland (Coppins, Hawksworth & Rose in press), but is a remarkable increase from the two recorded in the previous survey by Dr F. Rose (McClintock 1964). Lichens are particularly sensitive to sulphur dioxide air pollution, and amelioration in its levels are the primary cause of this dramatic change which has already been noted in the specialist and national press (Hawksworth 1996, Nuttall 1998).

As lichens are long-lived and detectable with a hand lens, the list is probably reasonably comprehensive, although some additional minute crustose species could have been missed, for example in crevices of stonework.

This contribution provides information on changes in local sulphur dioxide levels, the habitat ecology of lichens in Buckingham Palace Garden, and compares the site with others in Greater London.

Changes in sulphur dioxide levels

Sulphur dioxide levels have dropped dramatically in London since the 'killer smog' of December 1952, when levels reached 2,123 µg m^{-3} (0.75 ppm; conversion rate 1 ppm SO_2 = 2,830 µg m^{-3} at 15°C). This episode resulted in over 4,000 human deaths more than would have normally been expected, and led to the passing of the Clean Air Act in 1956. Subsequent introductions of clean air regulations, changes from coal to natural gas for heating, and the closure or relocation of industries and power stations have led to a continuing decline since that time.

Mean winter sulphur dioxide levels provide the best fits to lichen patterns as lichens are physiologically more active in the period September to March. In Westminster these values fell from 450 µg m^{-3} in 1962 to 150 µg m^{-3} in 1978 (Rose & Hawksworth 1981). Data from the same Westminster gauge have ceased to be collected, but by 1987 levels in central London were down to 44–48 µg m^{-3} (Hawksworth & McManus 1989). The main reason for this last drop was the closure of Battersea Power Station which ceased emissions in 1983.

In the period January to June 1996, weekly measurements of sulphur dioxide and nitrogen dioxide were obtained from samplers placed in Buckingham Palace Garden. During this period weekly values ranged from undetectable to 75 µg m^{-3} (26.5 ppb), and the mean from January to March was 26 µg m^{-3} (9.3 ppb). Nitrogen dioxide levels obtained from the same samplers gave weekly values in the range 23–53 ppb. The sulphur dioxide data collected during this time, while indicative of a continuing decline, cannot be computed to a winter mean value as no data were collected from September to December.

Particulate matter (smoke) values have not been analysed in the same depth as sulphur dioxide but follow a similar trend in the London area as a whole. Ozone is of particular and increasing concern in the region, but is not known to have harmful affects on lichens although it may adversely affect green plants. No data on ozone levels in the garden are available.

Habitat ecology

Bark and wood

Seventeen species were found on bark or wood. The *Salix* trees by the Lake (tree numbers 1818 and 1825) are the richest in the extent of lichen cover, with the most sulphur dioxide-sensitive species found in the survey, viz. *Evernia prunastri, Parmelia caperata,* and *Ramalina farinacea.* Although one *Salix* was cut down in 1996, and only the stump remains, no species were lost from the Garden as a result. The rough-barked basal areas of *Platanus* are the next most important site for lichens on bark and are better for species associated with nutrient-rich habitats, notably *Phaeophyscia orbicularis, Physcia adscendens, P. tenella* and *Xanthoria parietina. Platanus* (number 1802) was noteworthy in having *Evernia prunastri, Parmelia sulcata, Physcia tenella,* and *Ramalina* together on its base. One *Populus* (number 1836) was also of especial interest as the only site for three species in the Garden, *Caloplaca holocarpa, Lecanora dispersa* and *Rinodina exigua.*

The pollution-tolerant *Lecanora conizaeoides,* found only on one of the bridges in the previous survey, is now widespread but appears to be somewhat unhealthy, as in many areas of lowland Britain where sulphur dioxide levels have fallen dramatically.

Measurements of the diameter or heights of thalli are included in the species list below. Comparison with recorded growth rates (Fisher & Proctor 1978, Rose & Hawksworth 1981) suggest that the first *Parmelia caperata* became established in about 1992, and the first *P. sulcata* in about 1989. These data are consistent with previous findings regarding dates of colonization in the London area (see below). As is usual in areas formerly severely affected by sulphur dioxide pollution, the older vertical trunks of trees remain slow to be colonized by leafy (foliose) lichens. This is generally interpreted as due to the bark having become impregnated with pollutants during the periods of elevated air pollution.

Brick, stone, concrete, and roofing materials

The two bridges to the island on the Lake are made of a granular calcareous stone and have a spectacular lichen cover dominated by greyish and orange species. *Caloplaca citrina, Candelariella aurella, Lecanora flotowiana, L. muralis, Phaeophyscia orbicularis, Verrucaria viridula* and *Xanthoria parietina* predominate, but there are also substantial colonies of *Lecania erysibe* and *Rinodina gennarii.* Also noteworthy on the bridges are *Caloplaca decipiens* (also found on the balustrade on the west side of the Palace), *Phaeophyscia nigricans* and *Xanthoria elegans.* The limestone of the Summerhouse and the wall behind it were the next richest area, and this was the only site where *Catillaria lenticularis* was found in the Garden. Walls within the Garden tend to have similar assemblages of species to those on the bridges, but are relatively species-poor.

The stonework of the Palace itself is disappointing lichenologically as it appears to be deliberately kept 'clean', although one mossy area yielded *Collema crispum,* a cyanobacterial lichen not seen elsewhere in the Garden. Circular patches of *Lecanora muralis* have been allowed to persist in some unscrubbed parts of the main patio. The top of the balustrade on the west side of the Palace supported two small thalli of *Caloplaca decipiens,* and the rough sculptured wall below it supported ten species, including *Lecanora crenulata,* but was otherwise unremarkable. The west side of the Palace and its associated works were richer lichenologically than the north side.

The moveable cover of the Sandpit was noteworthy for the abundance of *Physcia caesia* and the generally scarce *P. dubia.*

Monuments in the Garden are generally kept clean, and the brickwork of the boundary wall is generally free of lichens except for species such as *Lecanora muralis.* A handsome colony of *Trapelia coarctata* on damp brickwork by the Storeyard was of especial note.

Soil

The only ground-dwelling lichen found in the present survey was *Cladonia fimbriata* on Small Island.

Comparison with other sites

Hawksworth & McManus (1989) presented species lists of lichen-forming fungi found on trees in fifty sites in the north-west quadrant of London. They found between two and twenty-two species at each site, and seven to seventeen in the central London parks. In the parks immediately adjacent to the Palace, they recorded seven species in St James's Park, and eleven in Green Park. These sites have not been resurveyed recently, but improvements in the lichens present would have been expected. Although *Parmelia caperata, P. subaurifera* and *Ramalina farinacea* were not then recorded in those two Parks, these and other pollution-sensitive species have all been gaining ground in London in the last 5–10 years. The *P. caperata* is of especial interest as it had not been recorded in London area between 1780 and 1988 (Laundon 1970, Hawksworth & McManus 1989). It now seems remarkable that less than thirty years ago the only site for the now frequent *P. sulcata* within 16 km of central London was one specimen on the concrete coping of a garden wall in Wood Green (Laundon 1970).

The species on trees that have recolonized are ones which would now be expected to be able to survive in central London on the basis of a comparison of the ambient levels of sulphur dioxide they tolerate in the field (Hawksworth & Rose 1970) and current levels of this pollutant (see above). For example, the presence of *Parmelia caperata* and *Phaeophyscia orbicularis* is indicative of mean winter sulphur dioxide levels of about 50 μg m^{-3} or less.

As sulphur dioxide levels have fallen rapidly, some species preferring more acid situations have not been able to colonize. Amongst such 'zone skippers' are species such as *Hypogymnia physodes* or *Platismatia glauca* which were not found in the Garden. Many other species in zone 7 or lower zones of Hawksworth & Rose's scale might be expected but have not yet been found in the site. Amongst these are characteristic 'zone-dawdlers' such as *Graphis, Opegrapha* and *Pertusaria* species (Gilbert 1992).

No systematic survey has been undertaken of species on stonework and similar substrata in the London area since that of Laundon (1970). This makes objective comparisons difficult as major extensions of ranges similar to those documented for species on trees have undoubtedly occurred. The recent colonists *Caloplaca decipiens, Physcia dubia* and *Xanthoria elegans* in the Garden are especially notable in this regard.

Prospects for the future

In a recolonizing situation, there is a certain serendipity in which species occur at what time. Foliose and shrubby lichens, including species of *Evernia, Parmelia* and *Ramalina,* are probably mainly brought into disjunct areas such as the Garden as asexual vegetative reproductive structures (e.g., soredia) and thallus fragments on the feet and in the feathers of birds. When one thallus is established, founder-effects come into play and the species can spread by rain trickles and invertebrates on the same tree and even to adjacent ones. For this reason it is not uncommon to find a single large and several smaller (younger) thalli of the same species close to one another.

Provided that sulphur dioxide levels remain as low as at present in the Garden, species such as *Candelaria concolor, Parmelia perlata, P. revoluta, Usnea subfloridana,* and *Xanthoria polycarpa* can all be expected to arrive in due course. All these species are now expanding widely in north-west London.

As most mature trees in the Garden are numbered, a re-examination of the same trees, and also the two bridges, in 5–10 years would be of interest to see how the recolonization process has continued.

The only other threats to lichens in the Garden are from the 'cleaning' or repairing of stonework. While repairs may be necessary from time to time, 'cleaning' should be discouraged in the interests of wildlife conservation. This is not only an issue for the lichens, but for moths and other invertebrates that need them for food, camouflage, or shelter. Some fungi are also found only on lichens, including several discovered in the Garden, such as *Bispora christiansenii.*

List of Lichen-forming fungi recorded from Buckingham Palace Garden

The nomenclature in this list follows Purvis, Coppins & James (1993) with later modifications. The single species recorded in both the previous and the present surveys is indicated by an asterisk (*), and one erroneous record from the earlier survey is placed in square brackets [. . .]. Numbers in brackets after the names of trees are those on the metal tags nailed to the trees. IMI = reference collection of the CAB International Bioscience UK Centre (Egham).

ASCOMYCOTA

Buellia punctata (Hoffm.) Massal., 1852: on *Salix* (1818) by the Lake; rare.

Caloplaca citrina (Hoffm.) Th. Fr., 1860: on mortar of wall of Silver Border, Sundial, wall behind and wall of Summerhouse, balustrade on west side of Palace, and Bridges Nos 1 and 2; frequent.

C. decipiens (Arnold) Blomb. & Forss., 1880: on Bridge No. 1 (a single specimen), and on balustrade on west side of the Palace (3 specimens, largest 1.1 cm diam.); rare.

C. holocarpa (Hoffm.) Wade, 1965: on *Populus* (1836); one specimen 0.75 cm diam; very rare.

Candelariella aurella (Hoffm.) Zahlbr., 1928: on wall of Silver Border, wall behind and of Summerhouse, balustrade on west side of House, and Bridges Nos 1 and 2; frequent.

C. vitellina (Hoffm.) Müll. Arg., 1894: on Bridge No. 2, also on rough *Populus* bark (1836); occasional.

Catillaria lenticularis (Ach.) Th. Fr., 1874: on limestone wall behind Summerhouse; scarce.

Cladonia fimbriata (L.) Fr., 1831: on ground on Small Island, and *Salix* stump by Lake (G6); rare.

[*C. foliacea* (Huds.) Willd., 1787: 'on peat blocks' (McClintock 1964). This is a species of well-drained calcareous or other basic soils, especially near the coast, and this record was evidently based on basal squamules of another *Cladonia* species. No specimen appears to have been retained, but this interpretation has been confirmed verbally with Dr F. Rose (pers. comm.).]

Collema crispum (Huds.) Weber ex Wigg., 1780: amongst mosses on damp shaded wall on north side of Palace; one small patch.

Evernia prunastri (L.) Ach., 1810: on *Fraxinus* base (1813), *Platanus* base (1802), and *Salix* (1825), a single specimen on each, the largest 1.5 cm tall.

Lecania erysibe (Ach.) Mudd, 1861: on Bridges Nos 1 and 2, on rockery stone in Mud Hole Walk and ballustrade on west side of House; occasional.

Lecanora albescens (Hoffm.) Branth & Rostrup, 1869: on wall of Summerhouse, and ballustrade on west side of House; occasional.

* *L. conizaeoides* Nyl. ex Crombie, 1885: on trees; very common. Recorded in the previous survey not on trees but 'on sandstone bridge' (McClintock 1964); found only on trees in the present survey.

L. crenulata Hook., 1833: on limestone wall of Summerhouse, and rough stonework below balustrade on west side of the Palace; rare.

L. dispersa (L.) Sommerf., 1826: on *Populus* bark (1836); scarce.

L. flotowiana Spreng., 1820: on wall of Silver Border, wall behind Summerhouse, balustrade on west side of Palace, Sundial, and Bridge No. 2; locally very common. The species to which most UK records of *L. dispersa* on rocks and walls refer, according to the concepts adopted in the revision of Fröberg (1997).

L. muralis (Schreber) Rabenh., 1845: on wall of Silver Border, flagstones of patio on west side of the Palace, wall behind Summerhouse, on Bridge No. 2, Sandpit cover, and boundary wall (Sects 22–23); locally abundant.

Lecidella stigmatea (Ach.) Hertel & Leuckert, 1869: on Bridge No. 2; scarce.

Lepraria incana (L.) Ach., 1803: on shaded dry bark of trees (e.g., 1825, 1837, 4794), *Salix* stump by Lake (G6), also boundary wall (Sect. 16); frequent.

Parmelia caperata (L.) Ach., 1803: on *Salix* (1818) by the lake, very rare, one thallus 0.6 cm diam; on *Salix* (1825) by the Lake, one thallus 2.2 cm diam.

P. subaurifera Nyl., 1873: on *Salix* (1793, 1818), occasional, thalli to 4.2 cm diam.

P. sulcata Taylor, 1836: on *Platanus* (e.g., 1802, 4964), *Salix* (e.g., 1793, 1818), and *Tilia* (4861); occasional, thalli to 2.7 cm diam.

Phaeophyscia nigricans (Flörke) Moberg, 1977: on Bridge No. 1; rare.

P. orbicularis (Necker) Moberg, 1977: on trees (e.g., *Platanus* 1719, 4964; *populus* 1836), Sandpit cover, balustrade on west side of Palace, and Bridges 1 and 2; locally abundant.

Physcia adscendens (Fr.) H. Olivier, 1882: on *Platanus* (4964), *Populus* (1836, 4859), and unidentified tree (1825); occasional.

P. caesia (Hoffm.) Fürnrohr, 1839: on Bridge No. 2, Sandpit cover, and *Platanus* base (4964); locally abundant.

P. dubia (Hoffm.) Lettau, 1912: on Sandpit cover; locally abundant, IMI 373915.

P. tenella (Scop.) DC., 1805: on trees (e.g., *Platanus* 1719, 1802, 1867, 4964), *Salix* 1818 and *Populus* 1836); locally abundant.

Porina chlorotica (Ach.) Müll. Arg., 1884: on ledge of patio wall, north side of the Palace; no ascospores obtained; rare.

Ramalina farinacea (L.) Ach., 1810: on *Platanus* base (1802); a single thallus; very rare.

Rinodina exigua Gray, 1821: on *Populus* (1836); rare.

R. gennarii Bagl., 1861: on wall below balustrade on west side of Palace, wall of Silver Border, Sundial, and on Bridges Nos 1 and 2; occasional.

Scoliciosporum chlorococcum (Graewe ex Stenhammar) Vězda, 1978: on *Platanus* base (1792), and rough bark of *Populus* (1836); scarce.

Trapelia coarctata (Sm.) M. Choisy, 1932: on damp horizontal brickwork, Storeyard; abundant on one wall.

Verrucaria muralis Ach., 1803: on pulmonite on The Mound; rare.

V. nigrescens Pers., 1795: on limestone wall of Summerhouse, and balustrade on west side of Palace; scarce.

V. viridula (Schrader) Ach., 1803: on wall of Silver Border, Summerhouse, balustrade on west side of Palace, and Bridges Nos 1 and 2; occasional.

Xanthoria elegans (Link) Th. Fr., 1860: on Bridge No. 2, two specimens, 1.2 and 1.4 cm diam.

X. parietina (L.) Th. Fr., 1860: on Bridges Nos 1 and 2, wall behind Summerhouse, and on bark of *Platanus* (1868, 4964), *Populus* (1836) and unidentified tree (4794); locally abundant, specimens to 3 cm diam.

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References

COPPINS, B. J., HAWKSWORTH, D. L. and ROSE, F. (in press). *Lichens*. In: *The changing wildlife of Great Britain and Ireland*. Taylor & Francis, London.

FISHER, P.J. & PROCTOR, M.C.F. 1978. Observations on a season's growth in *Parmelia caperata* and *P. sulcata* in South Devon. *Lichenologist* **10**: 81–89.

FRÖBERG, L. 1997. Variation in the *Lecanora dispersa* group in Sweden. *Symb. bot. upsal.* **32**(1): 29–34.

GILBERT, O.L. 1992. Lichen reinvasion with declining air pollution. *In*: Bates, J.W. & A.M. Farmer, (eds.) *Bryophytes and lichens in a changing environment*. 159–177. Oxford: Clarendon Press.

HAWKSWORTH, D.L. 1988. The variety of fungal-algal symbioses, their evolutionary significance, and the nature of lichens. *Bot. J. Linn. Soc.* **96:** 3–20.

HAWKSWORTH, D. L. 1996. *Parmelia caperata* reaches central London. *Bull. Br. Lichen Soc.* **78:** 45.

HAWKSWORTH, D.L. & McMANUS, P.M. 1989. Lichen recolonization in London under conditions of rapidly falling sulphur dioxide, and the concept of zone-skipping. *Bot. J. Linn. Soc.* **100**: 99–109.

HAWKSWORTH, D.L. & ROSE, F. 1970. Qualitative scale for estimating sulphur dioxide air pollution in England and Wales using epiphytic lichens. *Nature, Lond.* **227:** 145–148.

LAUNDON, J.R. 1970. London's lichens. *Lond. Nat.* **49**: 20–69.

McCLINTOCK, D. 1964. Bryophytes and fungi. In: McClintock, D. C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963: 36-38.

NUTTALL, N. 1998. Mystery at bottom of Queen's secret garden. *The Times* **66,372** (30 Nov. 1998): 8.

NASH, T. H. III (ed.) 1996. *Lichen biology.* Cambridge: Cambridge University Press.

PURVIS, O.W., COPPINS, B.J., HAWKSWORTH, D.L., JAMES, P. W. & MOORE, D.M. 1992. *The lichen flora of Great Britain and Ireland.* London: Natural History Museum Publications.

PURVIS, O.W., COPPINS, B.J. & JAMES, P.W. 1993. Checklist of lichens of Great Britain and Ireland. *Bull. Br. Lichen Soc.* **72**(Suppl.): 1–75.

ROSE, C.I. & HAWKSWORTH, D.L. 1981. Lichen recolonization in London's cleaner air. *Nature, Lond.* **289**: 289–292.

Non-lichenised fungi in Buckingham Palace Garden

It was originally planned to include a paper on the non-lichenised fungi in this first part of the report on the surveys at Buckingham Palace Garden. Around 700 species have been recorded, including two published as new to science. Many mycological specialists have contributed towards their identifications. Unfortunately, as a consequence of his many other commitments, Alick Henrici has been unable to complete the monumental task of compiling this particular section in advance of my strict deadlines. The reader is invited to consider that preparing the papers for this *Supplement* is an entirely voluntary labour on the part of all the authors; when dealing with over seven hundred species, all of which require to be critically examined under a microscope, preparation of an accurate list and discussion thereon is especially time-consuming. The paper on non-lichenised fungi has, therefore, been held back and will appear in part 2, to be published in December 2001.

Bryophytes in Buckingham Palace Garden 1995 - 1998

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Summary

Sixty species of bryophyte were found in Buckingham Palace Garden during the period 1995 to 1998; this compares with thirty-one species in the 1960 to 1963 survey. Additions to the British flora since that time account for part of the increase. Reduction in air pollution is another significant factor. Attention is drawn to species of particular interest, and all species are listed, including four recorded in the earlier survey but not refound during the present work.

Introduction

There would be more mosses and liverworts in the garden 'if there were less pollution in the atmosphere, a less dry climate and less active gardening'. Such was the conclusion reached by the previous survey (McClintock 1964). Since then, the climate, despite wet or dry seasons, has not radically altered, and gardening is just as active. However, air pollution has been dramatically reduced, thanks to the Clean Air Acts of 1956 and 1968. Sulphur dioxide, a product of coal and oil consumption, was extremely harmful to London's bryophytes. Certain species became 'virtually extinct in central London and the inner suburbs during the worst of the pollution' (Adams & Preston 1990). With cleaner air, some are reappearing, a trend which seems to be reflected in Buckingham Palace Garden. Fifty-six moss and four liverwort species were found here during the present survey, from 1995 to 1998, compared with twenty-six mosses and five liverworts during the earlier work.

Not all of this increase is attributable to reduced pollution. Since the previous survey, there have been many additions to the British bryophyte flora. New species have been recognized, others have been subdivided, and aliens have arrived. *Hennediella macrophylla*, for example, a native of New Zealand, was first noted in London in 1968 and is now widespread in the central parks.

Three mosses recorded during the previous survey were not refound: these were *Weissia* sp., *Physcomitrium pyriforme* and *Eurhynchium hians* (*E. swartzii*), probably due to chance. The liverwort *Pellia epiphylla* was also not refound, possibly because its habitat has been lost. In the earlier survey, the best bryophyte site, of which there is now no trace, was 'the marshy ground by the lake where damp little-disturbed grassland supports at least 12 species'. In any case, with bryophytes some random gains and losses are inevitable, especially in such an intensively managed environment. For example two bog mosses, *Polytrichum longisetum* and *P. commune*, were introduced with peat blocks from Scotland in 1995, and the only colony of *Dicranoweisia cirrata*, which grew on an old weeping willow, was lost in 1996 when the tree had to be felled. However, most species recorded here are more or less permanently established in appropriate habitats.

These habitats include soft verges of the lake. In places, tangled tree roots reach the water and mosses grow among them, including the rarest found in the garden, a variety of *Bryum pseudotriquetrum*. Normally associated with marshes, fens and dripping rocks, it is infrequent in south-east England and very scarce in Middlesex, the only other record during the past half-century being from Ruislip Lido (Wiltshire & Ellis 1995).

The West Terrace, with its balustrades and other architectural features of Portland stone, provides nooks and crannies which harbour a mixture of very small mosses. Although almost invisible except in early spring, these are locally plentiful and include *Fissidens* species, *Tortula truncata* (*Pottia truncata*), *Didymodon rigidulus* (*Barbula rigidula*), *Bryum rubens* and pollution-sensitive *Syntrichia intermedia* (*Tortula intermedia*).

Several mosses which in nature grow on stone, such as *Syntrichia ruralis* (*Tortula ruralis*), were found on the picturesque boulders and rocky outcrops which adorn The Mound, despite the fact that these are artificial. Concocted from rubble and coated with realistically-moulded cement, they were made by the Pulham company and installed in 1904 (Festing 1985).

On the lawns, the expected mosses are present. In damp places they include *Calliergonella cuspidata* (*Calliergon cuspidata*) and *Rhytidiadelphus squarrosus*, which are absent from the drier neighbouring London parks. On moist ground under trees, *Atrichum undulatum* and *Plagiomnium undulatum* are well established. Except occasionally at their bases, the trees themselves are almost devoid of mosses. Nearly 20 species of *Barbula*, *Didymodon*, *Tortula*, *Pohlia*, *Bryum* and other small mosses are widespread through the garden, often mixed together.

The feet of passing tourists, who visit the Palace each August and September, must be responsible for the presence of *Hennediella macrophylla*. On leaving the Palace, they call at the souvenir shop, a temporary building by the eastern end of The Mound, before making their way out by the Back Path to Grosvenor Place. On the heavily trampled ground by the shop this tiny alien moss is now well established.

The liverworts *Lunularia cruciata* and *Marchantia polymorpha* are locally plentiful on dank clay. *Lophocolea bidentata* is thinly scattered among grasses by the lake, and fragments of *L. heterophylla* were found on damp ground in a shrubbery. *Pellia epiphylla*, present during the earlier survey, was not re-found from 1995 to 1998.

In all, Buckingham Palace Garden contains a good range of bryophytes, many more than were found during recent years in Hyde Park and Kensington Gardens combined (Wiltshire 1994). Seclusion, shade, architectural and landscaped features, together with a generous watering routine, provide an unexpectedly favourable environment.

List of bryophytes recorded from Buckingham Palace Garden

Nomenclature and arrangement follows Blockeel and Long (1998). An asterisk (*) indicates species recorded during 1960-63 survey. 'V' indicates that voucher specimens from the 1995 to 1998 survey are deposited inthe Cryptogamic Herbarium of The Natural History Museum.

MOSSES

Polytrichaceae

Polytrichum longisetum. A few plants (some fruiting) near Waterfall 1998, on peat blocks from Auchencorth Moss near Edinburgh, introduced 1995. Rarely seen in Middlesex. V.

P. commune. A few plants on above peat blocks 1998. A moss of bog and damp heath habitats, now scarce in the London area. V.

P. juniperinum. A few plants on old peat in shrubbery behind Herbaceous Border 1996. V.

* *Atrichum undulatum*. Well established under hornbeam between Waterfall and Mudhole; also on lawn near Tea-house and on Mound. V.

Dicranaceae

* *Ceratodon purpureus*. Widespread.

* *Dicranella heteromalla*. A few plants in shrubbery behind Herbaceous Border 1995. V.

Dicranoweisia cirrata. On leaning willow (felled 1996) opposite Flamingo site. V.

* *Campylopus pyriformis*. In flower-pot in greenhouse 1996 (det. L. T. Ellis). V.

C. flexuosus (*C. paradoxus*). A few plants by Island shore 1997. V.

C. introflexus. First recorded in Britain in 1941. In flower-pot in Yard 1995 and sparsely by Island shore 1996, 1998. V.

Fissidentaceae

Fissidens bryoides. Locally abundant on West Terrace; also on Mound and along shaded path edges. V.

F. taxifolius. Sparsely on West Terrace and on Mound. V.

Pottiaceae

* *Weissia* cf *controversa*. Not refound.

Pseudocrossidium hornschuchianum (*Barbula hornschuchiana*). Occasional among other mosses. V.

Bryerythrophyllum recurvirostrum. A few plants on Island 1998.

* *Barbula convoluta*. In beds and by paths with other small mosses. V.

B. unguiculata. Frequent, especially on shaded stretches of path. V.

Didymodon rigidulus (*Barbula rigidula*). Small colonies on Portland stone of West Terrace balustrade 1998 (det. L. T. Ellis). V.

D. insulanus (*B. cylindrica*). Occasional among other mosses. V.

D. luridus (*B. trifaria*). A few plants by path behind Herbaceous Border 1996. V.

* *D. tophaceus* (*B. tophacea*). Occasional by Lake. V.

* *Tortula muralis*. Abundant on boulders. V.

T. modica (*Pottia intermedia*). A few plants in bed near Clock-tree Corner 1996.

T. truncata (*P. truncata*). On West Terrace, in beds, by paths and on Island. V.

T. acaulon (*Phascum cuspidatum*). Occasional in beds and by paths. V.

Hennediella macrophylla. First recognized in Britain in 1965. Fruiting plants on bare ground by souvenir shop site 1998. V.

Syntrichia ruralis (*Tortula ruralis*). A few plants on boulder by Back Path 1995. V.

S. intermedia (*T. intermedia*). Occasional at base of West Terrace parapet among *Bryum rubens*, etc. V.

Grimmiaceae

Grimmia pulvinata. Occasional on boulders. V.

Funariaceae

* *Funaria hygrometrica*. Frequent.

* *Physcomitrium pyriforme*. Not refound.

Bryaceae

* *Leptobryum pyriforme*. A few plants near 'Cranes' 1995 (det. L. T. Ellis). V.

* *Pohlia nutans*. Occasional on Island and by Lake. V.

* *P. annotina*. Among other mosses on West Terrace; a few plants on top of Mound 1998. V.

P. lescuriana. Not recognized in Britain until 1964. With *P. annotina* on West Terrace and on the Mound, 1998. V.

* *P. melanodon* (*P. carnea*, *P. delicatula*). Occasional by Lake. V.

* *Bryum capillare*. Frequent on boulders, paths and by Lake. V.

B. pseudotriquetrum var. *bimum*. Small colonies by west side of Lake between Bridge No. 1 and Table, at water's edge among compacted tree roots (det. L. T. Ellis). Rare in Middlesex. V.

* *B. caespiticium*. Frequent. V.

* *B. argenteum*. Occasional, especially on paths.

B. gemmiferum. Not recognized in Britain until about 1965 - formerly in **B. bicolor* complex. Frequent among other small mosses. V.

B. ruderale. First recognized in 1964 - previously in **B. erythrocarpum* complex. By path at rear of Herbaceous Border 1996 (det. L. T. Ellis). V.

B. rubens. Previously in **B. erythrocarpum* complex. Locally abundant on West Terrace and occasional throughout the garden. V.

Mniaceae

* *Mnium hornum*. At various sites on west side of Lake and on Mound. V.

Plagiomnium undulatum. Established in shrubbery by Clock-tree Corner. V.

Orthotrichaceae

Orthotrichum diaphanum. On base of sycamore by Herbaceous Border; occasional on other tree-bark and on boulders. V.

Amblystegiaceae

Amblystegium serpens. Frequent. V.

* *Leptodictyum riparium*. Occasional by Lake. V.

Calliergonella cuspidata (*Calliergon cuspidatum*). On moist ground between Mound and Lake; on shaded lawn near Tea-house. V.

Brachytheciaceae

Homalothecium sericeum. A few plants at base of horse-chestnut tree on Island 1995. V.

Brachythecium albicans. Plentiful on Island, occasional elsewhere. V.

* *B. rutabulum*. Widespread.

* *B. velutinum*. Rare at tree bases. V.

Rhynchostegium confertum. Frequent. V.

* *Eurhynchium praelongum*. Widespread. V.

* *E. hians* (*E. swartzii*). Not refound.

Hypnaceae

* *Hypnum cupressiforme*. Occasional. V.

H. resupinatum On bark of plane tree by Grosvenor Place Walk 1996. V.

Rhytidiadelphus squarrosus. On moist ground between Mound and Lake; on North Terrace lawn; on lawn near Tea-house. V.

LIVERWORTS

Geocalycaceae

* *Lophocolea bidentata* (including *L. cuspidata*). Occasional by Lake and in other moist locations. V.

* *L. heterophylla*. On damp ground in shrubbery 1995.

Pelliaceae

* *Pellia epiphylla*. Not refound.

Lunulariaceae

* *Lunularia cruciata*. Occasional in damp shaded sites; in flower-pots in Yard.

Marchantiaceae

* *Marchantia polymorpha* ssp. *ruderalis*. Occasional on damp ground by Lake; abundant on wet paving in Yard; in flower-pots. V.

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References

ADAMS, K.J. & PRESTON, C.D., 1990. Evidence for the effects of atmospheric pollution on bryophytes from national and local recording. In: Harding, P.T. (ed.) *Biological recording of changes in British wildlife*: 31-34. HMSO, London.

BLOCKEEL, T.L. & LONG, D.G., 1998. *A checklist and census catalogue of British and Irish bryophytes*. British Bryological Society.

FESTING, S., 1985. 'Pulham has done his work well'. *Garden History*, **12**(2): 140.

McCLINTOCK, D. 1964. Bryophytes and Fungi. In: McClintock, D. C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963: 36-37.

WILTSHIRE, E., 1994. The flora of Hyde Park and Kensington Gardens, 1988 - 1993. *Lond. Nat.* **73**: 37-60.

WILTSHIRE, E. & ELLIS, L.T., 1995. John Benbow (1821 - 1908) and the bryophytes of north-west Middlesex. *Lond. Nat.* **74**: 21-53.

Wild and naturalized vascular plants in Buckingham Palace Garden 1995 - 1998

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Summary

This paper lists the 322 taxa of wild and naturalized plants recorded in Buckingham Palace Garden from 1995 to 1998 and three added during 1999. About a hundred of these were new to the Garden. Three were new to Middlesex: *Selaginella kraussiana* Krauss's clubmoss, *Trachystemon orientalis* Abraham-Isaac-Jacob, and *Veronica hederifolia* ssp. *hederifolia* ivy-leaved speedwell. The nationally scarce hawkweed *Hieracium lepidulum* var. *haematophyllum* was refound, and London rarities included *Ophioglossum vulgatum* adder's-tongue, *Fumaria vaillantii* few-flowered fumitory and *Dactylorhiza fuchsii* common spotted orchid. The history of previous records is outlined. Of these, 218 taxa were refound and about a hundred not refound. They have been incorporated in this list, making a total of 431 taxa seen in the Garden since 1950. Attention is drawn to plants of particular interest. Recording was carried out, on average, weekly by the authors during the period 1995 to 1997, and occasionally during 1998.

Previous records

Galinsoga parviflora gallant-soldier, 'In the grounds of Buckingham Palace, Mme Dussan', was an early record published by G.C. Druce (1917), but it was not until 1950 that proper note was taken of the Garden flora. D.M. Eastwood, who was recording all the wild plants she could find in central London, had an opportunity to extend her list during a Palace garden party on 16 May 1950. In her book *Mirror of flowers* (1953) she refers to seven species, including *Hydrocotyle vulgaris* marsh pennywort. This was added to the hand-list of London plants then in course of publication (Kent & Lousley 1953), as was *Oenanthe crocata* hemlock water dropwort, which was among records personally communicated by her to D.H. Kent.

On 5 June 1956, J.C. Codrington, D.H. Kent, J.E. Lousley and D. McClintock visited the Garden to record its wild and naturalized flora. They found 'a thirty-nine acre haven walled off from the rest of the metropolis for over a century, well provided with water, bushes and other vegetation, free from public disturbance, and largely unexamined' (McClintock 1964). On 4 September they came again. Lousley (1957), reported that about 175 species had been listed, of which he published fourteen. McClintock returned on 9 April 1957 to make further records, and in 1960 Kent published 63 of the species so far found.

Meantime a team of scientists had been assembled to study the Garden's natural history in general, and the 1960-1963 survey took place. Particulars of the wild and naturalized plants, including the 1956 and 1957 records, amounting in all to nearly 270 taxa, were included in the comprehensive report (McClintock 1964).

From 1964 to 1994, McClintock continued to make occasional visits and to note additions to the Garden flora, including *Ophioglossum vulgatum* adder's-tongue, which featured in radio and television programmes, and *Euphorbia hirta* asthma-plant, new to Britain. In all, he added some fifty further plants, of which fourteen were published from time to time. These, and his unpublished records, are incorporated in this list. Many of the records referred to above were summarized by D.H. Kent in his *Historical Flora of Middlesex* (1975). A Supplement to this work is due for publication during 1999, and will include some records from this survey.

1995-1998 survey

A new survey of the wild and naturalized flora began in March 1995. Visits by the authors, together or separately, took place on a more or less weekly basis throughout the first three seasons, and occasionally in 1998. Three hundred and twenty-five taxa were recorded, of which about a hundred were new to the Garden. Of these, three were also new to Middlesex: *Selaginella kraussiana* Krauss's clubmoss, *Trachystemon orientalis* Abraham-Isaac-Jacob, and *Veronica hederifolia* ssp. *hederifolia* ivy-leaved speedwell (Kent 1999).

Specialists were consulted regarding critical and other species, and many voucher specimens have been deposited in the Natural History Museum and elsewhere. All taxa found during this period are listed here, together with previous records, making a total of 431. Over one hundred previously recorded taxa were not refound. These included twenty-three of bird-seed origin, twelve waterside plants, seven trees and shrubs, six grasses and five dandelion species. Others had been introduced with plants and materials, or associated with landscaping works. Thus, only after the Cascade was built in 1961 were seen bulbous buttercup, two bittercresses, thale-cress, three St John's-worts, annual pearlwort, fairy flax, lanceolate willow-herb, pignut and two of the three speedwells (McClintock 1964). Of such arrivals, not all would survive even to a second season. Random weeds comprise the balance of 'missing' species.

Local habitats

The area of the Garden is about 16 hectares (39 acres) – its principal features are shown on the map on pages 2–3. These include the West Terrace of the Palace itself. On the inner side are a series of grassy banks which slope towards the basement. *Viola riviniana* common dog violet and *Galium verum* lady's bedstraw are among plants which have grown on these from at least the 1960s. A gravelled walk along the terrace overlooks the main lawn, where thousands of guests assemble during garden parties. This extends towards Hyde Park Corner, with The Lake to the left, and flower beds and shrubberies to the right. The boundary walls along Grosvenor Place and Constitution Hill are lined with trees and shrubs, beneath which wild plants are little disturbed.

The lake, covering 1.5 hectares (about 4 acres), has soft margins and a wealth of vegetation to the water's edge. It contains an island, connected by two bridges. For long, part of this was home to the flamingoes, but since these perished in 1996 the site has been re-landscaped. A separate islet is no longer accessible. Water supplies are recycled via the waterfall at the north-west tip of The Lake. Other lakeside features include a flight of stone steps and a pair of bronze Indian cranes.

The Mound, a high sinuous ridge formed when the Garden was laid out, screens service areas from the Palace. It is grassy, and landscaped with trees, shrubs and artificial boulders. Behind this is the Yard, site of the Garden's administrative area, through which plants and materials enter the Garden.

Wild species

Some species may have been present here since before the Garden was created. The best-known is *Chamaemelum nobile* chamomile, which was recorded by Merrett (1666) as being 'this side of Hyde Park', and just to the south of the present Garden (McClintock 1977). It forms portions of lawn turf. Riparian species also may have been part of the original vegetation. In the eighteenth century there were two small lakes nearby, on ground which had always been wet – about 1825 the present lake was formed. Plants that might have survived by seed or otherwise from earlier times include *Lycopus europaeus* gipsywort, *Scrophularia auriculata* water figwort, *Hydrocotyle vulgaris* marsh pennywort and *Oenanthe crocata* hemlock water dropwort (common locally in the seventeenth century).

Hydrocotyle vulgaris marsh pennywort is now a London rarity, decreasing in Middlesex (Kent 1999). It persists where The Lake margin is soft and tree-shaded – perhaps the only such habitat in the city. Other locally rare or uncommon plants include *Ophioglossum vulgatum* adder's-tongue. First noted here in 1979 by D. Mitchell, the then head gardener, it may have been present for much longer. A colony of *Geranium rotundifolium* round-leaved crane's-bill, flourishing in a shrubbery, was engulfed by earth-moving in 1997 but appears to be recovering. Also locally scarce are *Montia fontana* ssp. *chondrosperma* blinks, *Trifolium arvense* hare's-foot clover, and *Aira caryophyllea* ssp. *multiculmis* silver hair-grass.

Of particular interest is *Hieracium lepidulum* var. *haematophyllum*, a nationally rare hawkweed. A specimen collected in the Garden in 1956 was determined by P. Sell and C. West (Lousley 1958). Up to 1961, this also grew outside the Garden wall, on the projection towards Hyde Park, but was lost when the roundabout there was enlarged. In 1995, a good colony was found in the Garden, by the north edge of The Lake.

A plant of *Dactylorhiza fuchsii* common spotted orchid flowered on the east side of The Lake in 1995. It reappeared during following seasons and was still present in 1999. In 1998, across The Lake, several others bloomed among newly planted-out iris clumps. Their source was an orchid which had been rescued from an Essex building site about 1993 and deposited in the Palace Garden yard. Here it seeded into the neighbouring iris pots. In 1999, thirty spikes flowered.

The locally rare *Orobanche minor* var. *minor* common broomrape appeared in 1998, apparently on *Trifolium dubium* lesser trefoil. Other unlikely Inner London plants seen were *Cardamine bulbifera* coralroot and *Veronica catenata* pink water-speedwell.

Naturalized and casual species

Around The Lake, naturalized species such as *Lysimachia vulgaris* and *Lythrum salicaria*, yellow and purple loosestrifes, mingle with a diversity of reeds and sedges. In 1956 McClintock noted that an unusual sea club-rush here, *Bolboschoenus maritimus*, was 'very pale green and tall'. Recently a specialist, Dr Jane Browning, looked at the fruits of a specimen in The Natural History Museum and found that it had the characteristics of a Japanese species, *B. yagara* (Ohwi) R.E. Kozhevnikov as well as of *B. maritimus*, and was possibly of hybrid origin. The plant has since been lost from The Lake.

Elsewhere in the Garden, other species, planted long ago for decorative effect, grow in abundance. Prominent among these is a *Heracleum* giant hogweed, still defying precise identification. It differs from the usual *H. mantegazzianum* in being perennial, with shorter stems and an extra pair of leaflets (McClintock 1968). Another is *Chaerophyllum aureum* golden chervil from central Europe. It is as frequent here as *Anthriscus sylvestris* cow parsley, but flowers somewhat later and has aromatic foliage, which persists green for much of the year. It has been naturalized in Scotland since the early years of this century, but is a rare casual elsewhere in Britain.

Several varieties of once-prized knotweeds have long formed part of the lakeside vegetation. They have been closely studied by experts (details are in the archives of The Natural History Museum). Basically there are two species, *Fallopia japonica* Japanese knotweed, *F. sachalinensis* giant knotweed, their hybrid *F. x bohemica*, and the var. *compacta* of *F. japonica*. Attempts are now being made to clear them all from the Garden.

Many naturalized plants here are of accidental origin. Some derive from garden escapes and abandoned beds. In the past, peat blocks were an occasional source, bringing *Dryopteris dilatata* broad buckler-fern, *Erica* spp. heathers and *Molinia caerulea* purple moor-grass. Casuals sometimes arrive inadvertently with nursery stock, or introduced materials. When the flamingo site was renovated, soil was brought in to shore up the banks and *Fumaria vaillantii* few-flowered fumitory, a plant of chalk stubble and otherwise unknown in London, appeared. In 1997 another load brought *Chenopodium bonus-henricus* good-king-Henry and *Digitaria ischaemum* smooth finger-grass to the Yard. Usually such arrivals do not last long. However an alien which is surely here to stay is *Conyza sumatrensis* Guernsey fleabane, first recorded in London in 1983 (Burton 1995) and now rampant throughout the city.

Up to the early 1980s, birds were fed from a balcony on the north front of the Palace. On the gravel below fell what they did not eat. The resulting seedlings when grown on produced a surprising diversity of species. Among them was the pan-tropical *Euphorbia hirta* asthma-plant, not previously recorded in Britain (Burton 1979; Clement & Foster 1994). Seven bird-seed species had been recorded during the 1960-1963 survey, and with twenty similar casuals subsequently added by McClintock they form a significant proportion of past records. There is no record of bird-seed being used during this survey.

Conclusion

A remarkable range of wild and naturalized plants has been recorded in the Garden. About half comprises naturally-occurring species, and a quarter has originated through planting or other gardening operations. The balance consists mainly of transient weeds, common throughout London.

In the thirty-five years between the previous and current surveys about a hundred taxa were lost from the Garden's flora and another hundred gained. This turnover appears to be a consequence of intensive gardening and of chance, rather than a reflection of any particular trend, pollution level or climate variation.

This sheltered and well-watered site provides ideal habitats for plants which might not otherwise survive in central London. These include rarities already referred to, inconspicuous plants such as *Viola riviniana* dog violet and *Galium saxatile* heath bedstraw, and some of the waterside vegetation, as well as random exotics both native and introduced. The surveys demonstrate that a major contribution to the enrichment of London's flora is made by the wild and naturalized plants of Buckingham Palace Garden.

List of wild and naturalized vascular plants recorded from Buckingham Palace Garden

The nomenclature in this list and the order of the species follows Stace (1997). An asterisk (*), indicates records made from 1956 to 1964 (McClintock 1964). (DMcC) indicates unpublished records made by David McClintock between the two surveys. 'V' indicates that a voucher specimen has been retained; most of these are in the herbarium at The Natural History Museum.

Selaginaceae

Selaginella kraussiana Krauss's clubmoss. On shaded lawn near Tea-house. First record for Middlesex (Burton 1996: 142). V.

Equisetaceae

* *Equisetum arvense* field horsetail. Established near Bridge No. 1 and occasional near Steps. V.

Ophioglossaceae

Ophioglossum vulgatum adder's-tongue. A small colony opposite Flamingo site, first noted in 1979 (Burton 1980: 82). V.

Osmundaceae

* *Osmunda regalis* royal fern. A few planted clumps by Lake, persisting since 1959.

Dennstaedtiaceae

* *Pteridium aquilinum* ssp. *aquilinum* bracken. Near Firehole and occasional elsewhere.

Aspleniaceae

* *Phyllitis scolopendrium* hart's-tongue. Bifurcated fronds 1965 (DMcC). On Yard wall 1995; in crevice in west front of Palace 1997.

* *Asplenium ruta-muraria* wall rue.

Dryopteridaceae

* *Dryopteris filix-mas* male fern (Kent 1960: 43). Occasional by south-west wall.

* *D. dilatata* broad buckler-fern. Originally on peat blocks and still occasional.

Woodsiaceae

Matteucia struthiopteris ostrich fern. One plant at south end of Lake (det. A. Paul). Also planted in flower-bed.

Taxaceae

* *Taxus baccata* yew. Occasional seedlings.

Nymphaceae

* *Nymphaea alba* white water-lily (Eastwood 1953: 168). Still present between Island and Waterfall.

Ranunculaceae

Caltha palustris marsh-marigold. Probably planted (Lousley 1957: 15). 1965 (DMcC). Near Waterfall.

* *Ranunculus acris* meadow buttercup. Occasional.

* *R. repens* creeping buttercup. Occasional. V.

* *R. bulbosus* bulbous buttercup. Occasional.

R. sceleratus celery-leaved buttercup. 1969 (DMcC). In disturbed ground near Mudhole 1995; by Flamingo site 1997. V.

R. ficaria lesser celandine. Occasional.

R. hederaceus ivy-leaved crowfoot. Single plant in wallflower bed near Yard, on mulch from Yorkshire 1996 and 1997. V.

* *Aquilegia vulgaris* columbine. Single plant on Mound 1995.

Berberidaceae

Mahonia aquilifolium Oregon-grape. Single seedling 1995.

Papaveraceae

Papaver somniferum opium poppy. On sand in Yard 1998.

P. rhoeas common poppy. Two plants on disturbed ground by Waterfall 1995.

P. dubium ssp. *lecoqii* long-headed poppy. In new bed by Flamingo site 1997.

Chelidonium majus greater celandine. 1993 (DMcC). Established in shrubbery by south-west wall.

Fumariaceae

Pseudofumaria lutea yellow corydalis. In bed behind The Border 1995. V.

* *Fumaria officinalis* common fumitory. In bed near Silver Border 1996; on sand in Yard 1997. V.

F. vaillantii few-flowered fumitory. In new bed near Flamingo site 1997 (Burton 1998: 233). V.

Platanaceae

* *Platanus x hispanica* London plane. Seedlings often present.

Ulmaceae

Ulmus procera English elm (Kent 1960: 52).

Urticaceae

* *Urtica dioica* common nettle. Occasional, including in hanging garden.

* *U. urens* small nettle. Occasional.

Parietaria judaica pellitory-of-the-wall. Single plant in Yard 1996.

* *Soleirolia soleirolii* mind-your-own-business. Abundant by Clock-tree Corner. V.

Fagaceae

Fagus sylvatica beech. Single seedling 1997.

* *Castanea sativa* sweet chestnut. Seedlings rare.

* *Quercus cerris* Turkey oak.

Q. ilex evergreen oak. Occasional seedlings.

Q. robur pedunculate oak. Single seedling 1996.

Betulaceae

Betula pubescens downy birch. Seedling in shrubbery by north wall 1995.

* *Alnus glutinosa* alder.

Carpinus betulus hornbeam. Seedlings near Mudhole 1997.

Chenopodiaceae

Chenopodium bonus-henricus good-king-Henry. On introduced soil in Yard 1997.

* *C. rubrum* red goosefoot. Occasional, notably by Catenary in Rose Garden.

* *C. polyspermum* many-seeded goosefoot. Occasional, especially by Catenary in Rose Garden. V.

* *C. ficifolium* fig-leaved goosefoot (Kent 1960: 46). Now scarce.

* *C. album* fat hen. Now scarce.

* *Atriplex prostrata* spear-leaved orache. Now scarce.

* *A. patula* common orache (Kent 1960: 46). Single plant by Mudhole, 1995.

Spinacea oleracea spinach. Single plant by Mudhole 1995.

Amaranthaceae

Amaranthus retroflexus common amaranth. From bird-seed 1970 (DMcC). Plant on Island 1997. V.

A. standleyanus indehiscent pigweed. From bird-seed 1980 (DMcC).

Portulacaceae

* *Claytonia perfoliata* spring beauty (Kent 1960: 46). In daffodil patch 1998.

C. sibirica pink purslane. In recently-planted shrub bed. V.

Montia fontana ssp. *chondrosperma* blinks. Established on lawn north of Mound (det. S. M. Walters). V.

Caryophyllaceae

Moehringia trinervia three-nerved sandwort. By Lake near Flamingo site. V.

* *Stellaria media* common chickweed. Frequent.

S. pallida lesser chickweed. Single plant in container on North Terrace 1995.

S. neglecta greater chickweed. One large plant by Catenary 1978 (Burton 1979: 67). V.

* *S. graminea* lesser stitchwort. Among grasses by Lake, on Island and by sundial.

* *Cerastium fontanum* ssp. *vulgare* common mouse-ear. Frequent.

C. glomeratum sticky mouse-ear. Occasional in turf. V.

Myoston aquaticum water chickweed. Weed in Yard garden 1985 (Burton 1986: 198). Bed weed 1985-1988 (DMcC). Near Flamingo site 1997.

* *Sagina procumbens* procumbent pearlwort. Occasional.

* *S. apetala* ssp. *apetala* annual pearlwort. In error as ssp. *erecta* (Kent 1975: 213).

Scleranthus annuus annual knawel. 2 - 3 plants in flower bed 1967 (Lousley 1968: 9).

* *Spergula arvensis* corn spurrey.

* *Silene latifolia* ssp. *alba* white campion (Kent 1960: 46). In Arboretum 1997.

S. dioica red campion. Two plants near Recycling Centre 1995.

Vaccaria hispanica cowherb. From bird-seed 1981 (DMcC).

Polygonaceae

* *Persicaria amphibia* amphibious bistort (Kent 1960: 52).

* *P. maculosa* redshank. Now scarce.

* *P. lapathifolia* pale persicaria. Two plants on disturbed ground near Waterfall 1995.

P. hydropiper water-pepper. Single plant in Yard 1995.

* *Polygonum arenastrum* equal-leaved knotgrass. In Yard.

* *P. aviculare* knotgrass. North of Yard.

* *Fallopia japonica* Japanese knotweed. Many locations. V, also in herb. Loughborough and herb. Leicester.

* *F. japonica* var. *compacta*. Long established by Lake west of Table. V, also in herb. Loughborough and herb. Leicester.

F. x bohemica (*F. japonica* x *F. sachalinensis*). At least three locations (det L. Child & J. Bailey). V, also in herb. Loughborough and herb. Leicester.

* *F. sachalinensis* giant knotweed. Established by Lake. V, also in herb. Loughborough and herb. Leicester.

* *Fallopia convolvulus* black-bindweed. Occasional.

* *Rumex acetosella* sheep's sorrel. Occasional (Kent 1960: 52). Abundant in the Gut.

* *R. acetosa* common sorrel. A few plants on Island.

* *R. hydrolapathum* water dock. Probably planted (Eastwood 1953: 168, 175; Lousley 1957: 15). By southern margin of Lake.

* *R. crispus* curled dock. Established on Island; a plant in disturbed ground near Waterfall 1995.

* *R. conglomeratus* clustered dock. Occasional.

* *R. sanguineus* var. *viridis* wood dock (Kent 1960: 52). On Island.

* *R. obtusifolius* broad-leaved dock. Occasional.

Clusiaceae

* *Hypericum perforatum* perforate St John's-wort. A large plant in Silver Border 1996. V.

* *H. tetrapterum* square-stalked St John's-wort.

* *H. humifusum* trailing St John's-wort.

Malvaceae

Malva sylvestris common mallow. Single plant 1997. V.

M. neglecta dwarf mallow. 1993 (DMcC).

Violaceae

* *Viola riviniana* var. *minor* common dog violet. Established on West Terrace and by Lake opposite Flamingo site; single plant by Recycling Centre 1995 (conf. S.M. Walters). V.

* *V. arvensis* field pansy. Occasional weed.

Salicaceae

* *Salix caprea* goat willow.

* *S. cinerea* ssp. *oleifolia* grey willow.

Brassicaceae

Sisymbrium orientale eastern rocket. Occasional 1967-1968 (Lousley 1968: 9). Single plant in Yard 1995.

* *S. officinale* hedge mustard. Occasional.

Alliaria petiolata garlic mustard. Single plant by south-west wall 1995.

* *Arabidopsis thaliana* thale cress. Scarce.

Erysimum cheiranthoides treacle mustard. Two large plants in disturbed ground by Recycling Centre 1996.

Hesperis matronalis dame's-violet. In shrubbery by north wall 1995.

Barbarea vulgaris common wintercress. Single plant on disturbed ground near Waterfall 1996.

* *Rorippa palustris* marsh yellow-cress. 'Rubbish near Buckingham Palace' June 1833 (herb. York); 'Near Buckingham Palace' (Trimen & Dyer 1869: 28); in crack of North Terrace 1956 (Kent 1960: 45).

* *R. sylvestris* creeping yellow-cress. Plant by Flamingo site 1997.

Cardamine bulbifera coralroot. Several plants near Waterfall April 1998.

C. pratensis cuckoo flower. Established on south bank of Lake.

* *C. flexuosa* wavy bitter-cress. Occasional.

* *C. hirsuta* hairy bitter-cress. Locally abundant.

* *Capsella bursa-pastoris* shepherd's-purse. Occasional.

Thlaspi arvense field penny-cress. From bird-seed 1980 (DMcC). A plant on disturbed ground by Waterfall 1995; a few plants near Flamingo site 1997.

Lepidium virginicum least pepperwort. From bird-seed 1978 (Burton 1979: 67) (herb. E. J. Clement). V.

* *Coronopus squamatus* swine-cress (Kent 1960: 44).

* *C. didymus* lesser swine-cress. Near Recycling Centre 1999.

* *Brassica oleracea* cabbage. Single plants on disturbed ground by Lake 1995, 1997.

B. napus ssp. *oleifera* oil-seed rape. Single tall plant on West Terrace 1995, and 1997. V.

B. rapa turnip. From bird-seed 1978 (DMcC).

* *B. juncea* Chinese mustard. From bird-seed 1980 (DMcC).

* *Sinapis arvensis* charlock. Occasional by Recycling Centre and by Lake.

* *S. alba* white mustard.

* *Raphanus raphanistrum* wild radish (Kent 1960: 44).

Resedaceae

Reseda luteola weld. Single plant near Mudhole 1996.

Ericaceae

* *Calluna vulgaris* heather. In abandoned peat-bed near north wall 1995.

* *Erica ciliaris* Dorset heath.

* *E. tetralix* cross-leaved heath.

Primulaceae

* *Primula vulgaris* primrose. Planted but regenerating freely. On Mound, on Island, by north side of Lake and in Arboretum area.

P. veris cowslip. Planted on boat-house site, on Island and in Arboretum area.

* *Lysimachia vulgaris* yellow loosestrife. Probably planted (Eastwood 1953: 168, 175). Flourishing by Lake.

* *Anagallis arvensis* ssp. arvensis scarlet pimpernel. On disturbed ground near Waterfall 1995, by Flamingo site 1997.

Saxifragaceae

* *Saxifraga stolonifera* strawberry saxifrage.

Rosaceae

* *Filipendula ulmaria* meadowsweet. A few plants on Island.

Rubus polyanthemus bramble. 1985 (DMcC). On Mound 1995, 1998 (det. D. E. Allen). V.

* *R. laciniatus* cut-leaved bramble. On Mound.

* [*R. rubritinctus* bramble. Recorded as occasional 1960 - 1963, possibly in error.]

* *Potentilla anserina* silverweed (Kent 1960: 49).

* *P. reptans* creeping cinquefoil (not x *italica*, as recorded 1960 - 1963). Frequent. V.

* *Aphanes australis* slender parsley-piert (Kent 1960: 49 - recorded in error as *A. arvensis*). On Table.

Rosa caesia ssp. *glauca* (*R. afzeliana* aff. var. *glaucophylla* (Winch) Wolley-Dod) glaucous dog rose. Island 1985 (det. G. G. Graham) (Burton 1986: 198) and not seen since (herb. Sunderland).

* *R. canina* dog rose (Kent 1960: 49 as *R. dumetorum* and Kent 1975: 291 as *R. corymbifera*). Large bush on Island. V. These may all refer to the same species.

* *Prunus domestica* wild plum.

P. laurocerasus cherry laurel. Seedling in shrubbery by south-west wall 1995.

Sorbus aucuparia rowan. Seedling in shrubbery by north wall 1995.

* *Crataegus monogyna* hawthorn (Kent 1960: 50). In shrubbery by south-west wall 1995.

Fabaceae

* *Robinia pseudoacacia* false-acacia (Kent 1960: 48). Suckers.

* *Lotus corniculatus* common bird's-foot-trefoil (Kent 1960: 48). Plentiful by east bank of Lake and on Island. V.

* *Ornithopus perpusillus* bird's-foot (Kent 1960: 49).

* *Vicia cracca* tufted vetch (Kent 1960: 49). South-west side of Lake and on Island.

V. hirsuta hairy tare. In Arboretum. V.

* *V. tetrasperma* smooth tare. On Mound by Bombhole and in Arboretum. V.

V. sepium bush vetch. In Arboretum.

[*V. sativa* ssp. *sativa* common vetch. 1965 (Kent 1975: 262). Probably in error for the next species.]

V. sativa ssp. *segetalis*. On Mound by Bombhole, in Arboretum and by Lake opposite Flamingo site (det. R. M. Burton).

* *Lathyrus pratensis* meadow vetchling (Kent 1960: 49). On Island and south bank of Lake. V.

* *L. latifolius* broad-leaved everlasting-pea.

Ononis mitissima Mediterranean rest-harrow. From bird-seed 1980 (DMcC, herb. E.J. Clement). V.

Medicago lupulina black medick. 1966 (DMcC). Occasional. On Island, on south bank of Lake, in Yard 1995.

M. arabica spotted medick. On Mound near Bombhole.

* *Trifolium repens* white clover. Frequent.

* *T. hybridum* ssp. *hybridum* alsike clover (Kent 1960: 48). 1992 (DMcC). South bank of Lake 1998.

T. dubium lesser trefoil. (DMcC). Frequent.

T. hirtum rose clover. 1988 (DMcC).

T. micranthum slender trefoil. In Lawn 1995.

* *T. pratense* red clover. Now scarce.

T. lappaceum bur clover. From bird-seed 1982 (DMcC).

T. arvense hare's-foot clover. Near south end of Lake 1992 (DMcC). Still present.

* *Laburnum anagyroides* laburnum. Occasional seedlings.

* *Cytisus scoparius* broom.

Haloragraceae

* *Myriophyllum spicatum* spiked water-milfoil (Kent 1960: 50).

Gunneraceae

* *Gunnera manicata* giant-rhubarb. Planted by Lake 1959 and 1961, and still present.

Lythraceae

* *Lythrum salicaria* purple-loosestrife (Eastwood 1953: 168, 175; Lousley 1957: 15). 'In 1969 up to 7 feet 9 inches tall!' (DMcC). Flourishing around Lake.

Onagraceae

* *Epilobium hirsutum* great willow-herb. Occasional.

E. parviflorum hoary willow-herb. Single plant near Waterfall 1995.

* *E. montanum* broad-leaved willow-herb. Occasional.

* *E. lanceolatum* spear-leaved willow-herb. 1961 only - second record for Middlesex (Kent 1975: 83, 311).

E. tetragonum square-stalked willow-herb. Occasional. Single plants near Recycling Centre 1995 (det. G. Kitchener); opposite Flamingo site 1997; in Yard 1998.

* *E. roseum* pale willow-herb (Kent 1960: 50). Single plant in Yard 1995 (det. G. Kitchener).

* *E. obscurum* short-fruited willow-herb (Kent 1960: 50). Frequent.

* *E. ciliatum* American willow-herb. Frequent.

* *Chamerion angustifolium* rosebay willow-herb. Frequent.

Aquilifoliaceae

* *Ilex aquilifolium* holly. Occasional seedlings.

Euphorbiaceae

* *Mercurialis perennis* dog's mercury. Established on Mound by Back Path.

* *M. annua* annual mercury. Scarce.

Euphorbia helioscopia sun spurge. In hanging garden and near Waterfall 1995.

* *E. peplus* petty spurge. Occasional.

E. hirta L. asthma-plant. From bird-seed 1978 (Burton 1979: 67; Clement & Foster 1994: 200) (det. E. J. Clement).

Rhamnaceae

Rhamnus catharticus buckthorn (Kent 1960: 48).

Linaceae

* *Linum usitatissimum* linseed.

* *L. catharticum* fairy flax.

Hippocastanaceae

* *Aesculus hippocastanum* horse-chestnut (Kent 1960: 48).

A. indica Indian horse-chestnut. Single seedling near north wall 1997.

Aceraceae

* Acer pseudoplatanus sycamore. Frequent seedlings.

Simaroubaceae

Ailanthus altissima tree-of-heaven. Suckers on Mound.

Oxalidaceae

* *Oxalis corniculata* procumbent yellow oxalis. Occasional. Var. *atropurpurea* Planchon in Silver Garden.

O. stricta upright yellow oxalis. In Yard 1995.

O. acetosella wood sorrel. At edge of bed by Clock-tree Corner.

* *O. debilis* var. *corymbosa* large-flowered pink oxalis (Kent 1960: 47). In Rose Garden and near shed by north wall.

Geraniaceae

Geranium x oxonianum Druce's crane's-bill. Single plant among grasses on Mound near Ice-house 1995.

G. rotundifolium round-leaved crane's-bill. A colony by south-west wall near Recycling Centre. V.

G. dissectum cut-leaved crane's-bill. Occasional. V.

G. pusillum small-flowered crane's-bill. Path edge near Mudhole 1999.

* *G. molle* dove's-foot crane's-bill (Kent 1960: 47). Frequent. Some pale-flowered plants on Mound opposite Yard entrance (herb. Cambridge).

G. robertianum herb robert. Single plant by Waterfall 1997, plentiful 1998.

Araliaceae

* *Hedera helix* ssp. *helix* ivy. Noted on wall of Constitution Hill 1907, and elsewhere 1911. Currently in hanging garden, with ssp. *hibernica* and cultivars.

Apiaceae

* *Hydrocotyle vulgaris* marsh pennywort. Marshy edge of Lake (Eastwood 1953: 168, 175; Kent & Lousley 1953: 126; Lousley 1957: 15; Kent 1960: 50). Still well established. V.

* *Chaerophyllum aureum* golden chervil. (Lousley 1957: 15; Kent & Lousley 1957, vii: 349; Kent 1960: 51; 1962: 19). Locally plentiful. V.

C. temulum rough chervil. Single large plant near Arboretum 1996.

* *Anthriscus sylvestris* cow parsley. Frequent.

A. caucalis bur parsley. Near the Lake 1985 (Burton 1986: 198). On Island. V.

Scandix pecten-veneris shepherd's-needle. From bird-seed 1976 (DMcC).

* *Conopodium majus* pignut.

* *Oenanthe crocata* hemlock water-dropwort (Lousley 1957: 15; Kent 1960: 51). Locally frequent.

* *Aethusa cynapium* ssp. *cynapium* fool's parsley. Locally frequent.

Anethum graveolens dill. From bird-seed 1980 (DMcC).

Conium maculatum hemlock. Four tall plants by Recycling Centre 1995. V.

Sison amomum stone parsley. Two plants in hanging garden 1995-1999. V.

Ammi majus bullwort. From bird-seed c. 1980 (DMcC).

A. visnaga tooth-pick plant. From bird-seed c. 1980 (DMcC).

Pastinaca sativa parsnip. Three plants on west side of Lake 1967 (Lousley 1968: 9).

* *Heracleum sphondylium* hogweed. Occasional.

* *H. taxon*. A giant hogweed, with noticeable differences (McClintock 1968; Kent 1975: 338). Locally abundant, being reduced. V.

H. sphondylium x Buckingham Palace taxon. Rough shady ground near east end of Mound 11.ix.1974 (coll. DMcC., conf. W. Muirhead, herb. Edinburgh). V.

Torilis japonica upright hedge-parsley. 1985 (DMcC).

* *T. nodosa* knotted hedge-parsley (Kent 1960: 51).

Apocynaceae

* *Vinca minor* lesser periwinkle. Established on Mound.

Solanaceae

* *Lycium barbarum* Duke of Argyll's tea-plant.

* *Lycopersicon esculentum* tomato. Single plant in bed near Arboretum 1996. V.

* *Solanum nigrum* ssp. *nigrum* black nightshade. On disturbed ground near Waterfall 1995-1996.

* *S. dulcamara* bittersweet. Occasional. In shrubbery by south-west wall 1995; a fine white-flowered form in Yard to 1995 (conf. S. Knapp).

* *Nicotiana* sp. tobacco plant.

Convolvulaceae

* *Convolvulus arvensis* field bindweed. Scarce. Behind The Border 1995; on Mound.

* *Calystegia sepium* hedge bindweed. (Kent 1960: 53). Established by Firehole, occasional elsewhere. V.

* *C. silvatica* large bindweed. Established by Firehole. V.

Cuscutaceae

* *Cuscuta epithymum* dodder. On heather in peat blocks by Summer-house 1964 - 1966 (Kent 1975: 396).

Boraginaceae

Anchusa azurea garden anchusa. Garden escape In Yard 1995 - 1998.

Borago pygmaea slender borage. Garden escape in Yard 1995 - 1998. V.

Trachystemon orientalis Abraham-Isaac-Jacob. Good patch under weeping willow on Island 1996. New to Middlesex (Kent 1999).

Myosotis arvensis field forget-me-not. One plant on disturbed ground near Waterfall 1995.

Verbenaceae

* *Verbena bonariensis* Argentinian vervain. On disturbed ground by Waterfall 1995.

* *V. x hybrida* verbena.

Lamiaceae

Stachys officinalis betony. Planted colony persisting in Arboretum.

* *S. sylvatica* hedge woundwort. Near Mudhole 1999.

* *Ballota nigra* ssp. *meridionalis* black horehound. Occasional.

* *Lamium album* white dead-nettle. Occasional.

* *L. purpureum* dead-nettle. Occasional.

* *L. amplexicaule* henbit dead-nettle (Kent 1960: 55). On east end of Mound and by Back Path.

* *Galeopsis bifida* bifid hemp-nettle.

Scutellaria galericulata skullcap. By south margin of Lake; opposite Flamingo site 1997.

* *Ajuga reptans* bugle. Rare. Established on Island; West Terrace 1995. V.

* *Glechoma hederacea* ground ivy. On Island 1995. The Gallery Bank, where f. *rosea* Neuman had become well established, was later demolished.

* *Prunella vulgaris* self-heal (Kent 1960: 54). Occasional.

Thymus pulegioides large thyme. A few plants in old peat-bed behind Rose Garden (det. R. M. Burton). V.

* *Lycopus europaeus* gypsywort (Kent 1960: 54). Established around Lake.

* *Mentha arvensis* corn mint. East side of Lake 1967 (Kent 1975: 422). A patch near 'Cranes' on east side of Lake.

* *M. x gracilis* (*x gentilis*) bushy mint.

* *M. aquatica* water mint. On Island near Flamingo site 1997 (conf. R. M. Harley). V.

Plantaginaceae

* *Plantago major* ssp. *major* greater plantain. Occasional.

P. major ssp. *intermedia*. Lawn by Waterfall 1977 (Burton 1978: 79).

* *P. media* hoary plantain.

* *P. lanceolata* ribwort plantain. Occasional.

P. afra plantain. From bird-seed 1980 (DMcC).

Buddlejaceae

* *Buddleja davidii* butterfly-bush. Seedlings.

Oleaceae

* *Fraxinus excelsior* ash. Seedlings.

Scrophulariaceae

* *Verbascum thapsus* common mullein.

* *Scrophularia nodosa* common figwort. In shrubbery by south-west wall 1995; Mudhole 1997.

S. auriculata water figwort. At various waterside sites since at least 1991.

* *Mimulus moschatus* musk. By Catenary in Rose Garden.

Asarina procumbens trailing snapdragon. Well established near Yard since 1980. V.

Cymbalaria muralis ivy-leaved toadflax. A few plants on Yard wall.

Linaria purpurea purple toadflax. One plant near Hyde Park Corner 1997. V.

* *Kickxia elatine* sharp-leaved fluellen. A few plants on disturbed ground near Waterfall 1995. V.

K. spuria round-leaved fluellen. A few plants on disturbed ground near Waterfall 1995. V.

* *Digitalis purpurea* foxglove. Established on Island; one plant near 'Cranes' 1995.

* *Veronica serpyllifolia* thyme-leaved speedwell. Scarce.

V. chamaedrys germander speedwell. Locally frequent near Lake.

V. beccabunga brooklime. By Lake near 'Cranes' 1995; on damp refurbished soil near Flamingo site, and on wet pavement in Yard 1997.

V. catenata pink water-speedwell. Several plants on damp refurbished soil near Flamingo site 1997 (conf. J. Burnett). V.

* *V. arvensis* wall speedwell. Scarce. On Island.

V. agrestis green field speedwell. 1965 (DMcC) (Kent 1975: 414). On Island 1997. V.

V. polita grey field speedwell. On West Terrace 1991 (DMcC). V.

* *V. persica* common field speedwell (Kent 1960: 54). Occasional.

V. hederifolia ssp. *hederifolia* ivy-leaved speedwell. Single plant near Yard 1996. New to Middlesex (Kent 1999).

* *V. hederifolia* ssp. *lucorum* ivy-leaved speedwell. Occasional.

Orobanchaceae

Orobanche minor var. *minor* common broomrape. By south bank of Lake 1998, apparently on *Trifolium dubium* lesser trefoil. V.

Campanulaceae

Campanula rotundifolia harebell. Nursery stock planted on Mound about 1990 and persisting. V.

Lobelia erinus garden lobelia. On gravel of North Terrace 1965 - 1982 (DMcC).

Rubiaceae

* *Sherardia arvensis* field madder.

* *Galium aparine* cleavers. Occasional.

* *G. verum* lady's bedstraw. Long established on West Terrace and still plentiful (Burton 1996: 142).

G. saxatile heath bedstraw. On peat blocks 1965 - 1966; in lawn south-east of Waterfall 1989 (DMcC). In lawn near south bank of Lake 1995, between Arboretum and tennis court 1997.

Caprifoliaceae

* *Sambucus nigra* elder. Occasional seedlings.

Dipsacaceae

Dipsacus fullonum teasel. One plant at Mudhole 1996.

Asteraceae

* *Arctium minus* lesser burdock. Single large plant at Mudhole 1998.

Carduus crispus ssp. *multiflorus* welted thistle. One plant at Mudhole 1996.

* *Cirsium vulgare* spear thistle. Occasional.

* *C. arvense* creeping thistle. Occasional.

Onopordum acanthium cotton thistle. Several plants naturalized by Firehole.

* *Centaurea diluta* lesser star-thistle.

* *C. nigra* common knapweed. Scarce. Established on Island.

* *Lapsana communis* nipplewort. Frequent.

* *Hypochaeris radicata* cat's-ear. Frequent.

* *Leontodon autumnalis* autumn hawkbit. On west side of Lake and on West Terrace. V.

Picris echioides bristly ox-tongue. Occasional. 2m tall on Island 1995. V.

* *Tragopogon pratensis* ssp. *minor* goat's-beard. Occasional (Kent 1960: 57). A few plants near 'Cranes' 1995, by Bridge No. 2 1997.

* *Sonchus arvensis* perennial sow-thistle. Large colony by Recycling Centre.

* *S. oleraceus* smooth sow-thistle. Occasional.

* *S. asper* prickly sow-thistle. Occasional (Kent 1960: 57). V.

* *Lactuca serriola* prickly lettuce. 1979 - 1985 (DMcC). Several plants near Recycling Centre 1995.

Taraxacum hamatulum dandelion. West Terrace 1975 (DMcC) (det. A. J. Richards). V.

T. hamiferum. Mound 1993 (DMcC) (det. A. J. Richards). V.

T. acroglossom. North of Yard 1997 (det. A. J. Richards). V.

T. angustisquameum (probably). Mound 1998 (det. A. A. Dudman). V.

T. croceiflorum. Mound 1993 (DMcC) (det. A. J. Richards) V.

T. ekmanii. Mound 1997 (det. A. J. Richards). V.

T. sublaeticolor. Heather bed 1969 (DMcC) (det. A. J. Richards). Mound 1998 (det. A. A. Dudman). V.

T. tenebricans. Heather bed 1969 (DMcC) (det. A. J. Richards). V.

* *Crepis capillaris* smooth hawk's-beard. Occasional.

* *C. vesicaria* ssp. *taraxacifolia* beaked hawk's-beard. Two plants on West Terrace 1995.

Hieracium trichocaulon hawkweed. Locally plentiful near Lake. V.

* *H. lepidulum* Stenstr. var. *haematophyllum* Dahlst. hawkweed (Lousley 1958: 185; Kent 1960: 57, 1975: 494; Bellamy 1984: 171). Refound 1995, well established on north-east side of Lake. V.

H. umbellatum. 1991 (DMcC).

* *Gnaphalium uliginosum* marsh cudweed (Kent 1960: 56). Two plants north of Yard 1995.

* *Pulicaria dysenterica* common fleabane. East side of Lake 1969 (Kent 1975: 465). By Lake near 'Cranes'.

* *Telekia speciosa* yellow ox-eye.

* *Solidago altissima* Canadian golden-rod.

* *S. gigantea* early golden-rod.

Aster x versicolor late Michaelmas-daisy. One plant by Lake near Mudhole 1995 and 1998 (det. R. M. Burton). V.

* *A. novi-belgii* confused Michaelmas-daisy.

Erigeron acer blue fleabane. Three plants on West Terrace 1996. V.

* *Conyza canadensis* Canadian fleabane. Frequent.

C. sumatrensis Guernsey fleabane. Less frequent.

* *Bellis perennis* daisy. Frequent; f. *discoidea* Hus by Waterfall 1988 (DMcC). Recently much affected by the Australian rust fungus *Puccinia distincta*.

* *Artemisia vulgaris* mugwort. Plants near Flamingo site, in The Border, and by Lake 1997.

* *Achillea millefolium* yarrow. Frequent.

* *Chamaemelum nobile* chamomile. Locally frequent, probably native, in lawns (Kent 1960: 56; McClintock 1977.). Still locally frequent.

* *Anthemis cotula* stinking chamomile.

* *Leucanthemum vulgare* ox-eye daisy (Kent 1960: 57). Abundant on Island. V.

* *Matricaria recutita* scented mayweed. Frequent.

* *M. discoidea* pineapple-weed. Near Waterfall 1992 (DMcC).

* *Tripleurospermum inodorum* scentless mayweed. By Recycling Centre 1995. V.

* *Senecio doria* golden ragwort.

* *S. jacobaea* common ragwort (Kent 1960: 56). Occasional.

* *S. squalidus* Oxford ragwort. Occasional.

* *S. vulgaris* groundsel. Frequent.

* *S. viscosus* sticky groundsel (Kent 1960: 56).

* *Tussilago farfara* colt's-foot. Established near Waterfall.

* *Petasites fragrans* winter heliotrope. Large well-established male colony on Mound above Ice-house. V.

* *Guizotia abyssinica* niger.

* *Galinsoga parviflora* gallant-soldier. Dussan 1916 (Druce 1917; Lousley 1957: 15). Occasional.

* *G. quadriradiata* shaggy soldier (Lousley 1957: 15). Locally frequent.

Eupatorium cannabinum hemp agrimony. Single plant near Flamingo site 1997.

Alismataceae

* *Alisma plantago-aquatica* water-plantain. Noted by Eastwood (1953: 175) but possibly gone in 1963.

Araceae
* *Acorus calamus* sweet-flag (Lousley 1957: 15). Near Steps to Lake.
* *Arum maculatum* lords-and-ladies (Kent 1960: 58). A plant at east end of The Border 1998.
* *Arisarum proboscideum* mouse-tail-plant. One plant behind Tea-house 1960 - 1963, gone by 1975 (DMcC).

Commelinaceae
* *Tradescantia zebrina* wandering sailor.

Juncaceae
* *Juncus tenuis* slender rush.
* *J. bufonius* toad rush. Occasional by Lake. V.
* *J. articulatus* jointed rush.
* *J. inflexus* hard rush. In heather bed 1992 (DMcC).
* *J. effusus* soft-rush. Near Steps to Lake and by Waterfall 1995. V.
* *Luzula campestris* field wood-rush (Kent 1960: 58). Near west bank of Lake.

Cyperaceae
* *Eleocharis palustris* common spike-rush (Kent 1960: 59).
* *Bolboschoenus maritimus* sea club-rush (Lousley 1957: 15; Kent 1960: 58; 1975:547). V.
* *Schoenoplectus lacustris* common club-rush (Kent 1960: 58). Established by south end of Lake.
* *Cyperus longus* galingale. Various sites by Lake.
* *Carex ovalis* oval sedge.
* *C. hirta* hairy sedge (Kent 1960: 59). A few plants on Table. V.
* *C. acutiformis* lesser pond-sedge (Lousley 1957: 15; Kent 1960: 59). A few plants by south and south-east margins of Lake (det. R. M. Burton). V.

C. pendula pendulous sedge. Three plants 1967 (Lousley 1968: 9). On Island near Bridge No. 1.
* *C. acuta* slender tufted-sedge (Lousley 1957: 15; Kent 1960: 59). By south margin of Lake (det. R. M. Burton). V.

Poaceae
* *Festuca pratensis* meadow fescue (Kent 1960: 59).
* *F. arundinacea* tall fescue (Kent 1960: 59). A few plants near Bridge No. 1.
* *F. rubra* (sensu lato) red fescue. Frequent. V.
* *F. ovina* (sensu lato) sheep's-fescue.
* *Lolium perenne* perennial rye-grass. Frequent.
* *L. x boucheanum* (*L. perenne* x *L. multiflorum*) hybrid rye-grass.

L. multiflorum Italian rye-grass. A few plants. V.
Vulpia bromoides squirrel-tail fescue. On Island. V.
V. myuros rat's-tail fescue. Locally abundant in Arboretum. V.
* *Cynosurus cristatus* crested dog's-tail (Kent 1960: 59). Occasional. V.
* *Poa annua* annual meadow-grass. Plentiful.
* *P. trivialis* rough meadow-grass (Kent 1960: 59). Occasional.
* *P. pratensis* smooth meadow-grass. Occasional.
* *P. nemoralis* wood meadow-grass (Kent 1960: 59).
* *Dactylis glomerata* cock's-foot. Frequent, covering much of Mound.
* *Glyceria maxima* reed sweet-grass (Lousley 1957: 15; Kent 1960: 60).

Arrhenatherum elatius ssp. *elatius* false oat-grass. Occasional tussocks.
* *Trisetum flavescens* yellow oat-grass. Occasional along north side of Lake and in Arboretum. V.
* *Deschampsia cespitosa* tufted hair-grass.
* *Holcus lanatus* Yorkshire fog (Kent 1960: 60). Frequent.

* *H. mollis* creeping soft-grass (Kent 1960: 60). Occasional.

Aira caryophyllea ssp. *multiculmis* silver hair-grass. Locally abundant in Arboretum (det. R. M. Burton).

* *Anthoxanthum odoratum* sweet vernal grass (Kent 1960: 60). Occasional.

* *Phalaris arundinacea* reed canary-grass (Kent 1960: 60).

P. canariensis canary-grass. From bird-seed 1980 (DMcC).

* *Agrostis capillaris* common bent. Frequent. V.

A. x *murbeckii* (*A. capillaris* x *A. stolonifera*). Pre-1988 (DMcC) (det. T. Cope, herb. Kew). V.

* *A. gigantea* black bent. On Island and near 'cranes'. V.

* *A. stolonifera* creeping bent. Occasional.

A. scabra rough bent. One large plant 1967 (Kent 1975: 637). V.

* *Alopecurus pratensis* meadow foxtail (Kent 1960:60). Occasional.

* *A. geniculatus* marsh foxtail (Kent 1960: 60).

A. myosuroides black-grass. Occasional since 1991.

* *Bromus hordaceus* soft-brome. Frequent.

Anisantha sterilis barren brome. Occasional.

* *Elytrigia repens* common couch. Occasional.

Hordeum distichon two-rowed barley. One plant by Recycling Centre 1996.

H. secalinum meadow barley. Single plant 1997.

Triticum aestivum bread wheat. Two plants 1995.

* *Cortaderia selloana* pampas-grass.

* *Molinia caerulea* purple moor-grass. Introduced with peat blocks 1964 (Kent 1975: 563).

* *Phragmites australis* common reed (Lousley 1957: 15; Kent 1960: 59). Established by Lake, perhaps planted.

Eleusine tristachya American yard-grass. From bird-seed 1980 (DMcC, hb. E. J. Clement). V.

Panicum miliaceum common millet. From bird-seed 1974, 1978, 1982 (DMcC).

Echinochloa utilis Japanese millet. From bird-seed 1974, 1980 - 1982 (DMcC).

Setaria viridis green bristle-grass. From bird-seed 1981 - 1982 (DMcC).

Digitaria ischaemum smooth finger-grass. In Yard on introduced soil 1997. V.

D. ciliaris tropical finger-grass. From bird-seed 1976 - 1978; in quantity 1980 - 1982 (DMcC).

Typhaceae

* *Typha latifolia* bulrush. Planted 1902, exterminated by 1960 (Kent 1975: 544).

T. angustifolia lesser bulrush. Established by south side of Lake.

Liliaceae

Convallaria majalis lily-of-the-valley. A patch by west side of Lake.

Ornithogalum angustifolium star-of-Bethlehem. Among daffodils near Mudhole 1998. V.

* *Scilla siberica* Siberian squill. On Island.

* *Hyacinthoides non-scripta* bluebell. Occasional.

* *H. non-scripta* x *H. hispanica* hybrid bluebell. Locally abundant.

* *H.hispanica* Spanish bluebell. Occasional.

* *Allium moly* golden garlic. Long established above Ice-house. V.

A. ursinum ramsons. At base of tree near Bridge No. 1 from 1996.

Tristagma uniflorum (*Ipheion uniflorum*) spring starflower. In Yard 1996.

Iridaceae

* *Iris pseudacorus* yellow iris. (Eastwood 1953: 175). Established at several sites around Lake.

I. foetidissima stinking iris. A clump at rear of The Border 1997.

Orchidaceae

Dactylorhiza fuchsii common spotted orchid. Single plant by Lake near 'cranes' 1995-1999. A dozen plants by Lake near Mudhole, among transplanted iris clumps 1998; thirty flowering spikes in 1999.

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References

ALLEN, D. E., 1965. The flora of Hyde Park and Kensington Gardens. *Proc. bot. Soc. Br. Isl.* **6**: 1-20.

BELLAMY, D., 1984. *The Queen's hidden garden.* David & Charles.

BURTON, R. M., 1978. Botanical records for 1977. *Lond. Nat.* **57**: 79.

BURTON, R. M., 1979. Botanical records for 1978. *Lond. Nat.* **58**: 67.

BURTON, R. M., 1980. Botanical records for 1979. *Lond. Nat.* **59**: 83.

BURTON, R. M., 1983. *Flora of the London area.* London Natural History Society.

BURTON, R. M., 1986. Botanical records for 1985. *Lond. Nat.* **65**: 198.

BURTON, R. M., 1995. The present distribution of Guernsey fleabane *Conyza sumatrensis* in the London Area. *Lond. Nat.* **74**: 169.

BURTON, R. M., 1996. Botanical records for 1995. *Lond. Nat.* **75**: 142.

BURTON, R. M., 1997. Botanical records for 1996. *Lond. Nat.* **76**: 199.

BURTON, R. M., 1998. Botanical records for 1997. *Lond. Nat.* **77**: 233.

CLEMENT, E. J., 1987. Exotics. *Wild Flower Magazine* **384**: 86.

CLEMENT, E. J. & FOSTER, M. C., 1994. *Alien plants of the British Isles.* London.

DRUCE, G. C., 1917. New county and other records. *Rep. Bot. Soc. & E. C.* **IV** (V): 490.

EASTWOOD, D. M., 1953. *Mirror of flowers.* Verschoyle.

KENT, D. H., 1960. A contribution to the flora of central London. *Lond. Nat.* **39**: 41-62.

KENT, D. H., 1962. Additions and corrections to the flora of central London. *Lond. Nat.* **41**: 16-22.

KENT, D. H., 1975. *The historical flora of Middlesex.* Ray Society.

KENT, D. H., 1999. *Supplement to the historical flora of Middlesex.* Ray Society.

KENT, D. H. & LOUSLEY, J. E., 1951 - 1957. A hand-list of the plants of the London Area. *Lond. Nat.* **30 - 36** Suppl.: 126; 133; vii; 349.

LOUSLEY, J. E., 1957. Botanical records for 1956. *Lond. Nat.* **36**: 11-15.

LOUSLEY, J. E., 1958. Botanical records for 1957. *Lond. Nat.* **37**: 185.

LOUSLEY, J. E., 1968. Botanical records for 1967. *Lond. Nat.* **47**: 9.

McCLINTOCK, D., 1964. Wild and naturalized vascular plants. In: McClintock, D. C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963: 14-25.

McCLINTOCK, D., 1968. Giant hogweeds in Great Britain. *Gardeners' Chronicle* 164(7): 8.

McCLINTOCK, D., 1977. 'Treneague' chamomile. *The Garden* **102** (5): 224.

MERRETT, C., 1666. *Pinax rerum naturalium britannicarum.* London.

STACE, C., 1997. *New flora of the British Isles.* Cambridge.

TRIMEN, H. & DYER, W. T., 1869. *Flora of Middlesex.* London.

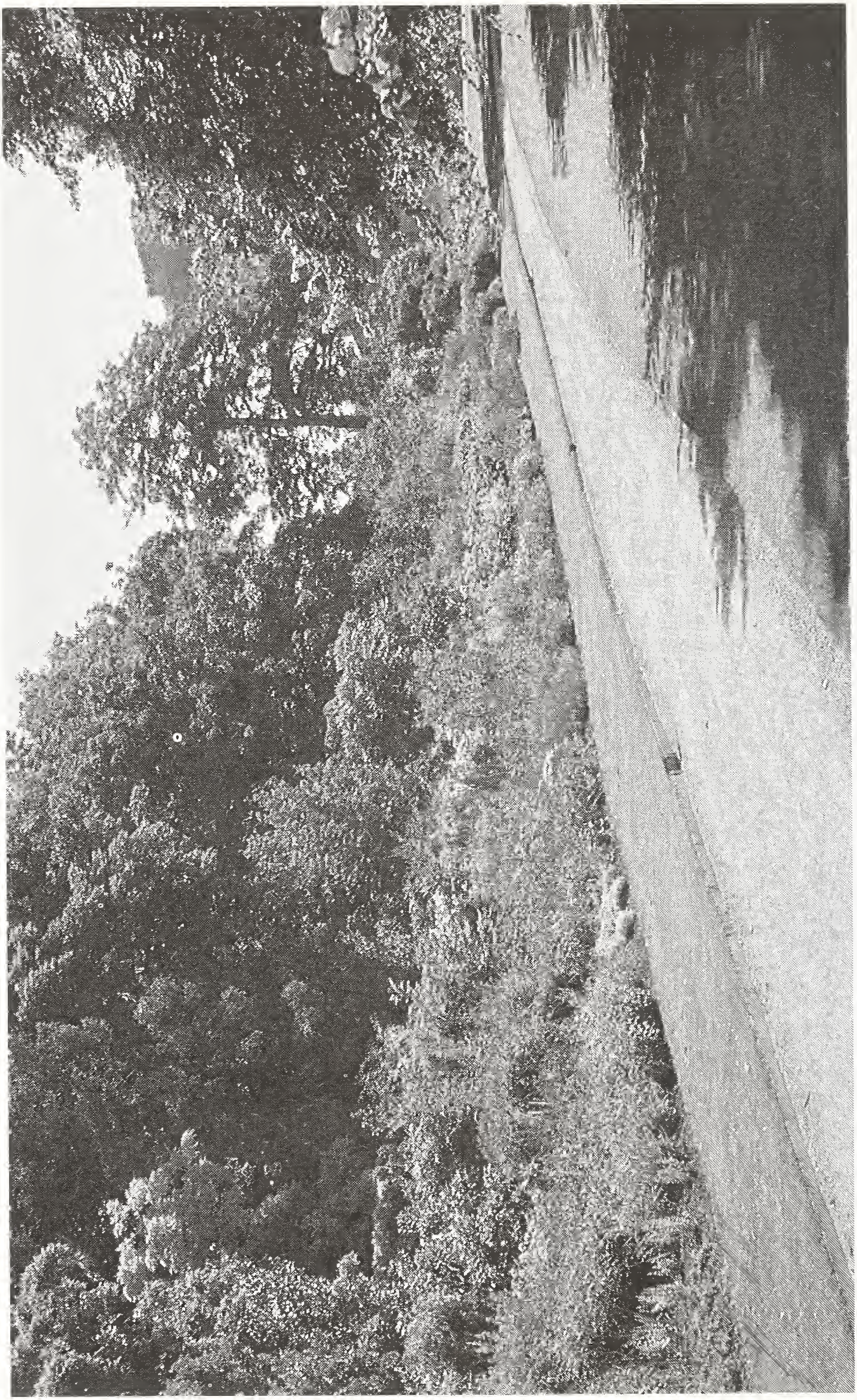

PLATE A. Buckingham Palace Garden, London. View of The Border, towards the Palace, August 1999.

Photographed by Mark Lane.

Garden plants in Buckingham Palace Garden

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The 3,650 cultivated plants in the Garden represent a wide range and diversity and there are too many to list here. However, we have selected the most appropriate plants to exemplify the variety. The mix of plants ranges from the native to the exotic and from the tree to the waterlily and fern. The Garden benefits from the effect of the centre of town remaining a few degrees warmer than the surrounding countryside. This produces less severe and shorter-lasting frosts and a higher average mean temperature creating an advancement of the season, usually by three weeks.

Recording history

No accession or planting records exist prior to the mid 1950s. Evidently they were not considered too important. An interesting comment comes from Mr Thomas Hay, a previous Royal Parks Superintendent, and helps us to understand why there are so few records of older plantings — 'I do not think it worthwhile naming trees like Cherry and Magnolia as they are small and don't last long'. The only indication of age of some of the trees is the plaque, if the tree was planted for a special occasion. The noting of the garden plants by the three previous Head Gardeners and by ourselves has, however, been ongoing since the last survey, which began in 1961.

The survey from 1961 to 1963 (McClintock 1964), listed 509 woody plants and 235 herbaceous plants and bulbs. At present, there are some 2,400 different woody plants, 850 herbaceous, 200 bulbs and 100 roses with 100 other plants in the lean-to glasshouse. All of the areas in the Garden were surveyed between 1995 and 1997. The explanation for the disparity in numbers between the two surveys is partly accounted for by the inclusion of many new and rare species into the collection, accommodated in the new beds and borders formed both by the removal of old plantings and the creation of more. The Border, which runs parallel to Constitution Hill, no longer includes seasonal bedding and instead is planted with herbaceous plants, bounded to the east by shrubs.

Throughout this work references and sources to names have been taken from *The plant finder* (Royal Horticultural Society, 1998/9).

Summary of findings

Trees

Although one hundred mature elms were removed from the Garden as a consequence of Dutch elm disease (the last in 1980), and the Garden also lost six mature trees in the 1987 and 1990 storms, trees remain the dominant feature. The most numerous species is the London plane *Platanus* x *hispanica*. Some of these trees are likely to date back to the early nineteenth century. A specimen of *Platanus* 'Augustine Henry' was found amongst these. This is an uncommon plane, which is rare except in central London. An avenue of Indian chestnut *Aesculus indica* and a circle of Lombardy poplar *Populus nigra* var. *italica* were planted in the early 1960s to provide a screen from the new high-rise buildings. A tree with a strangely shaped trunk, originally thought to be a sweet chestnut, was identified by Alan Mitchell as the very rare Chinese chestnut *Castanea mollissima*. The round-leaved beech *Fagus sylvatica* 'Rotundifolia' is another rare tree in central London. The Chinese *Photinia beauverdiana* var. *notabilis* in the Tea

House Bed was literally overlooked until quite recently, because its foliage was hidden by the rhododendrons and its trunk inconspicuous below. A young specimen of olive *Olea europaea* produced fruit for the first time in 1997.

During recent years some choice oaks have been planted, among them the Louisiana oak *Quercus* x *ludoviciana*, water oak *Q. nigra*, black-jack oak *Q. marilandica* and Lucombe oak *Q.* x *hispanica* 'Lucombeana'.

Native trees cultivated in the Garden are alder *Alnus glutinosa*, dwarf birch *Betula nana*, silver birch *Betula pendula*, hornbeam *Carpinus betulus*, hawthorn *Crataegus monogyna*, beech *Fagus sylvatica*, ash *Fraxinus excelsior*, grey poplar *Populus canescens*, wild cherry *Prunus avium*, English oak *Quercus robur*, crack willow *Salix fragilis*, whitebeam *Sorbus aria*, rowan *Sorbus aucuparia*, wild service tree *Sorbus torminalis*, lime *Tilia* x *europaea*, wych elm *Ulmus glabra* (as suckers) and English elm *U. procera* (as suckers). Recent plantings include black poplar *Populus nigra* (female) and aspen *Populus tremula*.

Beside these, there are fine specimens of sycamore *Acer pseudoplatanus*, tree of heaven *Ailanthus altissima*, strawberry trees *Arbutus* x *andrachnoides* and *A. unedo*, golden Indian bean tree *Catalpa bignonioides* 'Aurea', purple beech *Fagus sylvatica* Purpurea group, narrow-leafed ash *Fraxinus angustifolia* var. *lentiscifolia*, golden ash *Fraxinus excelsior* 'Jaspidea', mulberry *Morus nigra*, poplars *Populus* x *canescens*, *P.* x *canadensis* 'Aurea', *P. nigra* var. *betulifolia* and *P. trichocarpa*, Turkey oak *Quercus cerris* and pagoda tree *Sophora japonica*.

Frost-tender trees include *Alangium chinense* and bead tree *Melia azederach*.

Some which are rare in cultivation are Italian maple *Acer opalus*, red bud maple *Acer trautvetteri*, *Alnus* x *spaethii*, *Betula cordifolia*, *B. livinovii* and *B. luminifera*, pecan *Carya illinoinensis*, hackberry *Celtis occidentalis* var. *pumila*, *Crataegus armena* and *C. macranthera*, *Ehretia dicksonii*, *Ilex corallina*, Himalayan holly *I. dipyrena*, tanbark oak *Lithocarpus densiflorus*, red beech *Nothofagus fusca*, white oak *Quercus alba*, *Q. aliena*, Japanese emperor oak *Q. dentata*, *Q. glandulifera*, *Q. infectoria*, *Q.* x *libanerris* 'Rotterdam' and *Sassafras albidum*.

Conifers

These make up only a small part (2.6 per cent by species) of the contents of the Garden. Leyland cypress x *Cupressocyparis leylandii*, is placed to baffle the wind that funnels down the adjoining streets of Belgravia. Originally a group of three, they were thinned in 1980 to single specimens.

Native conifers cultivated in the Garden are Scots pine *Pinus sylvestris* and yew *Taxus baccata*.

Good, but relatively young specimens exist of the incense cedar *Calocedrus decurrens*, blue Atlas cedar *C. libani* ssp. *atlantica* Glauca group, deodar *C. deodara*, Arizona cypress *Cupressus arizonica*, larch *Larix decidua*, dawn redwood *Metasequoia glyptostroboides*, Japanese black pine *Pinus thunbergii*, Californian redwood *Sequoia sempervirens*, giant sequoia *Sequoiadendron giganteum*, swamp cypress *Taxodium distichum*, noble cypress x *Cupressocyparis notabilis* and Irish yew *Taxus baccata* 'Fastigiata'.

New plantings within the last ten years are Nootka cypress *Chamaecyparis nootkatensis*, bishop pine *Pinus muricata*, Monterey pine *Pinus radiata*, Bhutan pine *Pinus wallichiana*, pond cypress *Taxodium distichum* var. *imbricatum* 'Nutans', *Taxus baccata* 'Dovastoniana' and Japanese yew *T. cuspidata*. A yew *T. baccata* hedge was installed opposite the Silver Border in 1993 to replace old privet.

Shrubs

The most plentiful shrub in the Garden has long been the native holly *Ilex aquifolium*, with over 250 of them. They are mostly Victorian plantings, and clothe large areas of the Garden near Grosvenor Place and Constitution Hill, providing significant cover on The Mound. The privet, *Ligustrum ovalifolium* and spotted laurel *Aucuba japonica* 'Variegata' — Victorian plantings that dominated the shrubberies — have largely been removed over the past forty years and have been replaced with a wide variety of others shrubs. Plantings during this time have included many more evergreen shrubs with colourful flowers like rhododendrons and camellias. There is now a notable collection that provides colour and interest all year round. A dozen new beds have been planted in recent years. Along the Back Path are a number of old lilacs, one of which was identified as *Syringa* x *hyacinthiflora* 'Plena', very scarce in Britain with mature specimens known at only two other sites.

Native shrubs that are cultivated in the Garden are bog rosemary *Andromeda polifolia*, bearberry *Arctostaphylos uva-ursi*, box *Buxus sempervirens*, dogwood *Cornus sanguinea*, hazel *Corylus avellana*, mezereon *Daphne mezereum*, spindle tree *Euonymus europaeus*, sea buckthorn *Hippophae rhamnoides*, honeysuckle, *Lonicera periclymenum*, blackthorn *Prunus spinosa*, sweet briar *Rosa rubiginosa*, goat willow *Salix caprea*, elder *Sambucus nigra*, wayfaring tree *Viburnum lantana* and guelder rose *Viburnum opulus*.

Fine specimens include the green manzanita *Arctostaphylos patula*, *Azara serrata*, cornelian cherry *Cornus mas*, *Euonymus japonicus*, the hedgehog holly *Ilex aquifolium* 'Ferox', bay *Laurus nobilis*, *Magnolia delaveyi* and the Rouen lilac *Syringa* x *chinensis*.

The British Isles have an equable oceanic climate and as a result plants from many parts of the world can be grown. Hardiness zones are based on the average annual minimum temperature for each area (Krüssmann 1960):

Z9 = -7°C to -1°C

Z10 = -1°C to +5°C

Plants happily growing in the Garden that are at the lower end of the limit of hardiness are *Atherosperma moschatum* (Z9), camphor tree *Cinnamomum camphora* (Z9), ivy of Paraguay *Cissus striata* (Z10), lily of the valley tree *Clethra arborea* (Z9), *Coprosma robusta* (Z9), *Coronilla valentina* ssp. *glauca* (Z9), *Dichroa febrifuga* (Z10), *Dregea sinensis* (Z9), Chilean jasmine *Mandevilla laxa* (Z9), banana shrub *Michelia figo* (Z9), *Retama monosperma* (Z9), *Rhododendron dalhousiae* var. *rhabdotum* (Z9), *Ribes viburnifolium* (Z9) and *Ugni molinae* (Z9).

Scarce plants in the Garden are *Acer oliverianum*, Sitka alder *Alnus sinuata*, *Berberis congestiflora* and *B. holocraspidon*, *Betula apoiensis* and *Betula potaninii*, *Camellia fraterna*, *Clethra fargesii* and *C. monostachya*, *Cotoneaster atropurpureus* and *C. lucidus*, *Crataegus canbyi* and *C. jonesiae*, *Eleutherococcus sieboldianus*, *Eurya japonica*, *Fremontodendron californicum* ssp. *decumbens*, *Gaylussacia ursinum*, *Hydrangea scandens*, *Ligustrum sempervirens*, *Lindera umbellata*, *Loropetalum chinense*, *Mahonia gracilipes*, *M. mairei*, x *savillii* and *M. wilcoxii*, *Neviusia alabamensis*, *Orixa japonica*, *Osmanthus suavis*, *Philadelphus intectus*, *Pseudocydonia sinensis*, *Pseudopanax delavayi*, deer oak *Quercus sadleriana*, fragrant sumach *Rhus aromatica*, *Ribes hudsonianum*, *Spiraea gemmata*, storax *Styrax americanus* and sheepberry *Viburnum lentago*.

Although a stout wall surrounds the Garden, little of it is used for the cultivation of wall shrubs or climbers. Up to the 1930s, the wall between the Garden and the Royal Mews was clothed in ivies. This was replaced with *Forsythia*, *Chaenomeles*, *Escallonia*, *Cotoneaster* and *Pyracantha* which have been trained on wires. In 1993, more plants were added to the internal walls that extend from Electrician's Gate to the Back Path and are visible to the visitors during summer opening. These include *Ampelopsis brevipedunculata* 'Elegans', *Berchemia racemosa*, *Bignonia capreolata*, *Clematis armandii*, *Hydrangea seemanii*, *Kadsura japonica*, *Pileostegia viburnoides*, *Stauntonia hexaphylla* and *Trachelospermum jasminoides* 'Wilsonii'.

Roses

Most roses in the Garden are grown in the Rose Garden and this area contains formal island beds of hybrid tea and floribunda roses, with a long border behind the Admiralty Summerhouse with shrub and species roses. Climbing roses are grown over a catenary made up of columns and ropes. The ghost rose *Rosa fedschenkoana* is represented by a good specimen as well as *Rosa webbiana*.

Herbaceous plants

The Border situated along part of the eastern edge of the Garden parallel to Constitution Hill is designed to flower during the summer and this show continues into the autumn. The waterfall beds contain many new additions to the list and these produce colour and texture throughout the summer. Since their introduction, some of the herbaceous plants have successfully spread, including red baneberry *Actaea rubra*, *Anemone trifolia*, *Aquilegia canadensis*, lily of the valley *Convallaria majalis*, wild bleeding heart *Dicentra formosa*, snow poppy *Eomecon chionantha*, *Geranium nodosum*, lenten rose *Helleborus orientalis*, *Iris setosa* var. *arctica*, *Lamium orvala*, *Leptinella squalida*, fringed loosestrife *Lysimachia ciliata*, gooseneck loosestrife *L. clethroides*, *Mitella breweri*, *Pachyphragma macrophyllum*, *Persicaria alata*, Solomon's seal *Polygonatum* x *hybridum*, comfrey *Symphytum grandiflorum*, *Thymus rotundifolius*, toad lily *Tricyrtis formosana*, northern blue violet *Viola septentrionalis* and smooth yellow violet *V. pubescens* var. *eriocarpa* mixed with woolly blue violet *V. sororia* 'Freckles'.

Rarities include *Asclepias incarnata* 'Alba' and *Lomandra longifolia*.

There are no rock garden or alpine plants because the nature of the Garden is unsuitable.

Ferns

Most ferns are a recent addition to the Garden, where only the royal fern remains from the last survey's recordings. Some of the new plantings have spread, such as the American maidenhair fern *Adiantum pedatum*, hart's-tongue fern *Asplenium scolopendrium*, Japanese shield fern *Dryopteris erythrosora*, oak fern *Gymnocarpium dryopteris*, shuttlecock fern *Matteuccia struthiopteris*, sensitive fern *Onoclea sensibilis*, hard shield fern *Polystichium aculeatum*, *P. makinoi* and woodsia *Woodsia obtusa*.

Grasses, sedges and bamboo

Occasional plantings of this category include *Carex muskinguemensis*, *Hakonechloa macra* 'Aureola', *Imperata cylindrica* 'Rubra', lyme grass *Leymus arenarius*, switch grass *Panicum virgatum* 'Rubrum', gardener's garters *Phalaris arundinacea* 'Picta', *Phyllostachys viridiglaucescens* and golden oats *Stipa gigantea*.

Bulbs

Those that have naturalised are *Allium* x *hollandicum*, Neapolitan garlic *A. neopolitanum*, round-headed leek *A. sphaerocephalum*, wood garlic *A. ursinum*, *Anemone blanda*, winter aconite *Eranthis hyemalis*, snake's-head fritillary *Fritillaria meleagris*, *Ipheion uniflorum*, grape-hyacinth *Muscari armeniacum* and *M. neglectum*.

Conclusion

A lesson can be learned from the demise of the elm tree, and that is to vary the content of a garden and not be too reliant upon one species. Present tree and shrub planting involves the incorporation of a much wider selection. Few conifers are planted, because of the need to maintain the Garden 'in keeping' with a broadleaf planting policy that more suits the surroundings. Increasing the general plant collection is an important development allowing the Garden to become notable in its own right and providing a display of colour throughout the year.

References

KRÜSSMANN, G. 1960. *Cultivated broad-leaved trees and shrubs*. Vol. 1. Batsford.

McCLINTOCK, D. 1964. Cultivated Plants. In: McClintock, D.C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. Trans. S. Lond. ent. nat. Hist. Soc.* 1963: 26-35.

A survey of the fish population in Buckingham Palace Garden lake

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Abstract

Seine-netting and electro-fishing surveys of the Buckingham Palace Garden lake demonstrated that the fish population was of low species diversity and density with low to normal growth rates. The population was dominated by roach *Rutilus rutilus*, with smaller numbers of gudgeon *Gobio gobio* and perch *Perca fluviatilis*. Isolation and eutrophication are suggested to be key factors in structuring the composition of fish populations in Buckingham Palace Garden lake.

Introduction

Buckingham Palace Garden lake is unusual in several ways. It is a small lake maintained for purely ornamental purposes and is subject to only limited human impact. Although situated within the heart of the capital, it is unaffected by the increasing demand for lakes to be managed as locations for sporting pursuits. It could be considered an island within a 'sea' of urbanization.

Buckingham Palace and its Garden were remodelled as a private royal residence in the late eighteenth century. The lake was constructed as part of an informal parkland landscape (Anon 1993). Maintenance of water quality soon proved to be a problem. In 1854 the lake was due to be drained and converted into flowerbeds when the water source was found to be impure. Arrangements were made, however, to provide a clean water supply from an artesian well on Duck Island, St James's Park. Fish were introduced soon after, although they had to be relocated to Kensington Gardens in 1869 when the lake was concreted. Problems with water quality continued so that the lake was suspected to be a source of typhoid at Buckingham Palace in the hot summer of 1883, until an 'expert' sampled the water and declared it to be 'of excellent quality for dietetic purposes'. Regular maintenance improved water quality and, in 1941, the job of draining and cleaning was efficiently carried out by a gang of German prisoners of war (Coats 1978). The Royal Family have enjoyed the lake, both as part of a good view and for moments of relaxation. Queen Victoria, Prince Albert and their children regularly fed the wildfowl on the lake. As Royal Princesses, Elizabeth and Margaret showed great interest in the wildlife of the Garden and ensured that the royal fish were fed with regular supplies of water fleas, *Daphnia*, delivered in frozen portions by the 'flea man' (Peacock 1951). The walls built around the Garden have provided privacy for the Royal Family and created a protected enclave for the wildlife within.

As Buckingham Palace Garden lake is so isolated, it may be considered to possess many of the faunal characteristics of small oceanic islands. Within such habitats, species diversity and the probability of species extinction are likely to be influenced by habitat size (area) and the degree of isolation (MacArthur & Wilson 1967). Under natural circumstances, fish communities within isolated lake habitats, especially those of recent origin, tend to show poor species diversity because of difficulties of colonisation. Such isolated fish populations may fluctuate as a consequence of natural oscillations and cycles in breeding success, even to the point of population extinction. Unlike natural isolated lakes, however, Buckingham Palace Garden lake is buffered from many of the extreme environmental conditions such as drought or winter-kill that can influence fish population structure and composition. The impact of drought or lowering of the water level is reduced by supplementation with tap water. Additionally, the 'London heat island' effect serves to minimise the likelihood of prolonged freezing and consequent winter-kill.

In England and Wales, ponds and lakes may be spatially isolated, but they are not wholly subject to natural processes because they are accessible to human interference. Such water bodies are often popular resources, used for a variety of recreational activities and are therefore subject to management regimes. Angling constitutes the most popular participation sport in England, and thus many water bodies are maintained as fisheries. Management priorities frequently involve the introduction and maintenance of popular sporting fish populations, some of which may be non-endemic species, such as carp *Cyprinus carpio*, that may not be beneficial to lentic ecosystems. This form of management has become more prevalent with increasing urbanization of land around water bodies — the expansion of the human population resulting in a concomitant increase in the demand for recreational facilities. Fish populations at these sites are augmented by legal and illegal introductions and well-intentioned disposal of spare live-bait, unwanted pets and jam-jars of 'tiddlers' by the general public, particularly children acting under parental edict.

The high security walls of Buckingham Palace exclude the constant pressure of human interference and the lake is not subject to fisheries management. It is this very isolation and inaccessibility that makes it such an interesting habitat to study. A survey of the fish population within the lake at Buckingham Palace Garden was commissioned by the London Natural History Society and undertaken during the spring and summer of 1996. The purpose of the survey was to identify the fish species present within the lake and to investigate their status in terms of abundance, growth rates and condition.

Site description

The lake is of irregular shape and has an area of 1.56 hectares (Figure 1). Two islands are present; the larger, a rough oval approximately 93 metres across its longest axis, forms a central landmass around which the main body of the lake is curved. It is connected to the bank by two bridges. The smaller island, more nearly circular in shape and approximately 13 metres in diameter, is located slightly to the south of the larger island and is unconnected to the bank. Both are vegetated and have trees growing upon them. The immediate surrounds of the lake comprise a mixture of formal garden including standard and ornamental trees, extensive lawns and some areas of habitat managed for wildlife (Page 1984). In addition to the bridges, two structures abut the lake; a set of stone steps and the foundations of a boathouse.

The lake is shallow with an average depth of less than 1.5 metres. The benthic substrate comprises thick, black silt mixed with twigs and organic debris, presumably from trees surrounding or overhanging the water. At the time of sampling the major water source was artesian well water pumped from St James's Park, supplemented by precipitation and runoff from the Garden. This supply was discontinued, however, in 1997 due to degradation of pipework (pers. comm. Mrs Jennifer Adams, LVO, The Royal Parks). A pump extracts the water from the south-eastern end of the lake via a grilled intake. The water re-enters by means of a waterfall at the end of the north-western arm of the lake. The pipe carrying the water is located within the lake, under the surface of the water, running from one end of the lake to the other. Measurement of the physico-chemical parameters of water samples taken on 14 April 1996 showed conductivity was 730 µS, pH 8.4, calcium hardness 115 mg/l and carbonate hardness 3.6 SBVµM/l. The water was green and turbid (Secchi depth 38 cm) and appeared eutrophic.

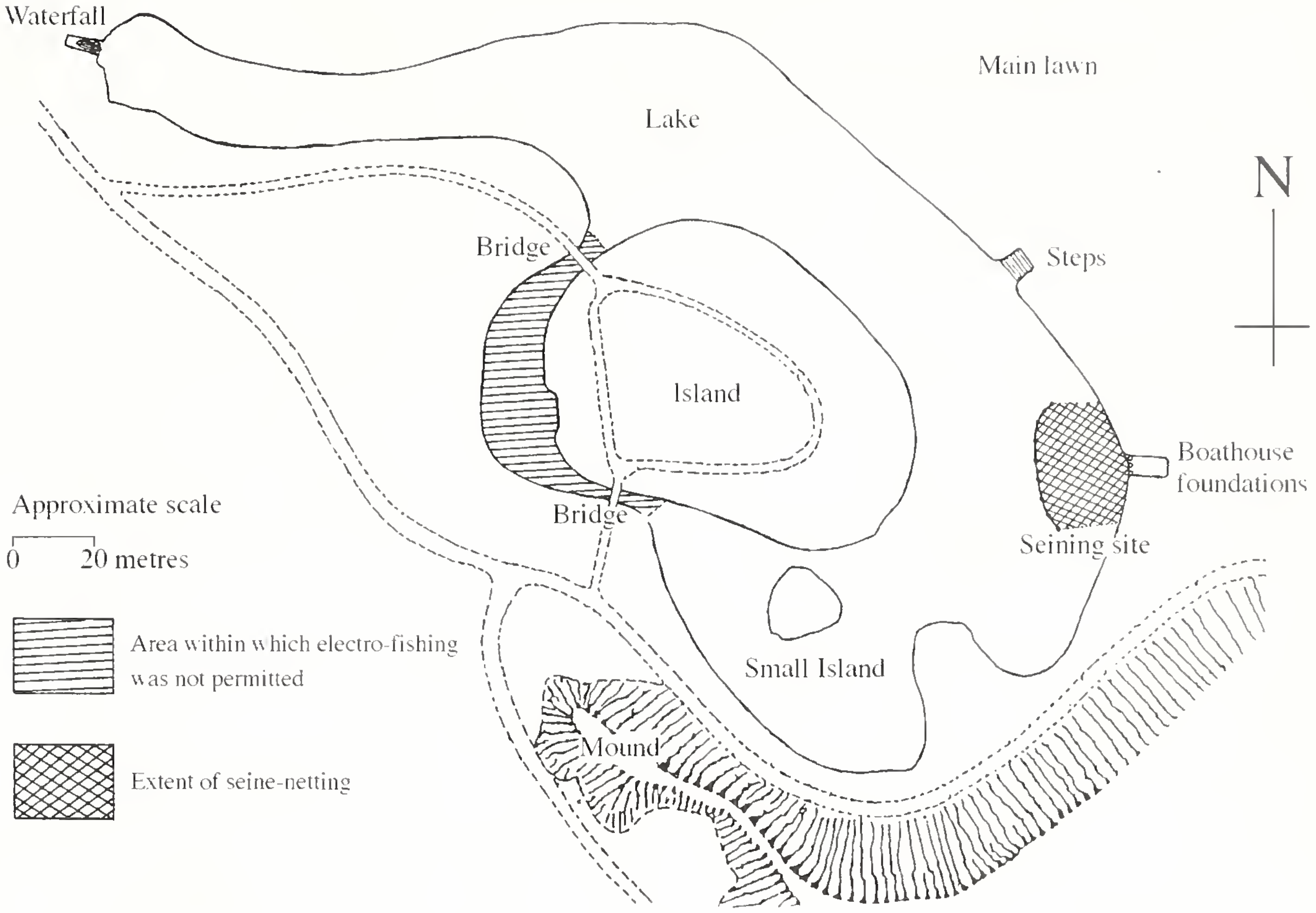

Figure 1: Buckingham Palace Garden lake, showing seining site.

There were no submerged macrophytes within the lake. Emergent and floating macrophytes such as *Sparganium* sp. and *Iris* sp. and some small beds of waterlilies *Nymphaea* sp., were located mainly within the north-western arm of the lake, below the waterfall. Macroinvertebrates appeared scarce within the lake, those found in the survey by Plant (in press) consisting of Heteroptera typically associated with organically-enriched, highly eutrophic waters (Sládečk & Sládečková 1994).

Methods

Sampling

Seine-netting was carried out on 5 May 1996 from the site of the old boat house on the eastern bank (Figure 1). The site was chosen to encompass the greatest variation in depth and the largest, easily-netted expanse of open water. The seine-net employed was 25 metres long, 2 metres deep, with 3 mm micromesh. The net was laid parallel to, and approximately 15 m from, the shore from a rowing boat. The total netted area was 360 m^2. The net was hauled inshore with minimum disturbance, an operator in a dry-suit ensuring that the floatline remained at the surface and leadline on the bottom to prevent escape of enclosed fish. The net was hauled onto the bank for sorting of captured fish. These were identified, measured (fork length to nearest mm), weighed (to nearest gm) and three to five scales collected from the appropriate location on the left flank, depending on species (Steinmetz & Müller 1991) before being returned to the lake. Six roach were in poor condition and were taken to the laboratory for autopsy.

A qualitative, electro-fishing survey was undertaken on 30 June 1996 to confirm the species composition of the fish population indicated by the quantitative seining. Electro-fishing was carried out by three operators in a rowing boat, one rowing, one netting immobilized fish, and the third operating a battery-powered, 12v pulsed DC, portable electro-fisher. All accessible portions of the lake were surveyed over a three-hour period. Immobilized fish were netted, identified, examined for external evidence of pathogens and were immediately returned to the lake.

Age and Growth Determination

Fish ages were determined by scale reading. Scales were cleaned by soaking in distilled water and rubbing between the finger and thumb, and were mounted in distilled water on slides. They were examined under a binocular microscope at x20 or x40 magnification, depending on the size of the scale and were measured with an eyepiece graticule. Scales were initially examined blind (i.e., without knowledge of the length of the fish from which they originated) and then examined with access to length data. When the two values did not agree, scales were re-examined and discarded if ambiguous.

Data obtained from the samples were used to construct length-weight relationships for the fish species sampled. Regressions of fish body-length on scale-radius were used in later analyses (back-calculation). Fish biomass (kg/ha) and growth rates were also calculated. Roach relative growth rates were determined using a standard index (Hickley & Dexter 1979). Predicted maximum roach length was calculated using a Walford Graph (Ricker 1975).

Fraser-Lee back-calculations (Equation 1) were carried out for all fish species sampled. Back-calculation uses measurements made on a fish at one time to infer its length at an earlier time or times. Measurements utilized are length of fish at time of capture and dimensions of one or more marks on some hard part of the fish. In this case hard parts were scales, marks measured being annual checks in growth that are recorded upon scales as annuli.

Equation 1: Fraser-Lee Back-calculation equation

$$L_i = c + (L_c - c)\left(\frac{S_i}{Sc}\right)$$

Where: L_i = *Fish length at time of i^{th} radius*
S_i = *Scale radius at time of i^{th} radius*
L_c = *Fish length at time of capture*
S_c = *Scale radius at time of capture*
c = *fish length at scale formation*

Results

The survey indicated that the fish population was of low species diversity and consisted of three species: roach *Rutilus rutilus* (Linnaeus, 1758), gudgeon *Gobio gobio* (Linnaeus, 1758) (Order Cypriniformes) and perch *Perca fluviatilis* Linnaeus, 1758 (Order Perciformes). Total fish numbers and biomass caught by seine within the lake are given in Table 1, together with estimates of species biomass/ha. These data indicate that the lake supports approximately 80 kg/ha of the three fish species combined. The roach population contributes the majority of this biomass (over 78 per cent).

Seine-netting showed that the roach population was composed of 1–6+ (year old) individuals with a length range of 69–151 mm. A Walford graph suggests that roach in the lake may reach a maximum size of approximately 200 mm (Figure 2). Comparison of length:age data with a standard curve constructed from national data (Hickley & Dexter 1979), shows that growth is close to average when the roach are in their first year, but decreases markedly with age giving a population average of 83.6, much lower than the standard of 100. This calculation is supported by data obtained by scale analyses, the roach showing low mean annual growth increments (Figure 3a). Back-calculation data also indicate that growth patterns have probably remained similar for at least the past four or five years with little variation shown in the year-class:length relationship (Table 2). Some individuals of less than one year were obtained whilst electro-fishing, indicating that the roach population had reproduced the previous spring. Analysis of stomach contents of six roach taken for autopsy demonstrated that the fish diet at that time consisted of silt, plant material, oligochaete worms, crustaceans and insects. One roach was heavily infected with ectoparasitic protists *Trichodina* sp. that had covered the gill filaments. The other five roach were uninfected by parasites.

Netting results indicated that the gudgeon population was composed of fish aged 0–4+, 40–142 mm, but comprised mainly juvenile fish. Out of a total of 25 individuals analysed for age, 18 were immatures of two years old or younger.

Their back-calculated growth rate, however, conformed with normal growth values suggested by Maitland & Campbell (1992) for the species. At the end of their first summer they had reached 46 mm, 100 mm by the end of their second year and 114 mm by the time they were three years old (Table 3, Figure 3b). Although the number of older fish caught by seine was low, many adult fish were seen shoaling at the base of the waterfall during the electro-fishing survey, suggesting under-representation in the net sample. As with roach, young-of-the-year gudgeon were obtained by electro-fishing, indicating that breeding had been successful in the previous spring.

Both electro-fishing and netting demonstrated that the frequency of perch within the lake was low, although those caught appeared to be in good condition and ranged from 2–5+ and 94–175 mm in length. An insufficient number of individuals were caught for reliable analyses of population age or size structure. These data suggested that the perch in the lake were attaining lengths close to those suggested as normal by Maitland & Campbell (1992). As in the other two species, a few young-of-the-year perch were obtained by electro-fishing, indicating that breeding had occurred in the previous spring.

TABLE 1.
Number and biomass of fish caught by seine in Buckingham Palace Garden lake on 5 May 1996

Fish Species	Number in seine	Biomass (kg)	Biomass (kg/ha)
Roach	150	2.27	63.07
Gudgeon	45	0.35	9.73
Perch	8	0.27	7.50
Total	203	23.34	80.30

Discussion

Data obtained from the survey indicate a lake with a low diversity and density of fish with low to normal growth rates. Most still waters will support coarse fish populations of 300–800 kg/ha (Cooper 1991) and therefore the population density estimate of some 80 kg/ha suggests that the lake is below estimates for an optimal environment for supporting fish.

TABLE 2. Back-calculated lengths of Buckingham Palace lake roach *R. rutilus* obtained from measurement of scale annuli.

	Roach length (mm) at age:															
Age	*n*	0	95%	1	95%	2	95%	3	95%	4	95%	5	95%	6	95%	7
1	3	41	17	62	8	*74*	*21*									
2	16	38	2	60	4	83	4	*97*	*2*							
3	6	37	7	61	8	80	9	98	10	*109*	*5*					
4	11	37	1	58	4	78	8	101	7	118	4	*125*	*4*			
2	38	31	63	89	83	111	34	127	54	137	104	*144*	*89*			
6	1	39	–	52	–	67	–	105	–	122	–	135	–	145	–	*150*
	mean	38	1	60	2	81	3	99	3	116	4	128	4	144	18	150
	n	39		39		39		36		20		14		3		1

n number of fish in sample 95% 95% confidence interval age fish age in years (birthday taken as 1 June)

length in *italics* are 'plus growth' i.e., growth increments derived from the measurement taken from the annulus to the edge of the scale representing the growth since the fish's last birthday.

TABLE 3. Back-calculated lengths of Buckingham Palace lake gudgeon *G. gobio* obtained from measurement of scale annuli.

	Gudgeon length (mm) at age:									
Age	*n*	0	95%	1	95%	2	95%	3	95%	4
0	16	47	3	*60*	*4*					
1	4	45	4	76	6	*107*	*8*			
2	5	44	11	73	10	96	10	*113*	*11*	
3	1	47	–	75	–	104	–	119	–	*132*
	mean	46	2	65	4	100	6	114	9	*132*
	n	25		26		10		6		1

n number of fish in sample 95% 95% confidence interval age fish age in years (birthday taken as 1 June)

length in *italics* are 'plus growth' i.e., growth increments derived from the measurement taken from the annulus to the edge of the scale representing the growth since the fish's last birthday.

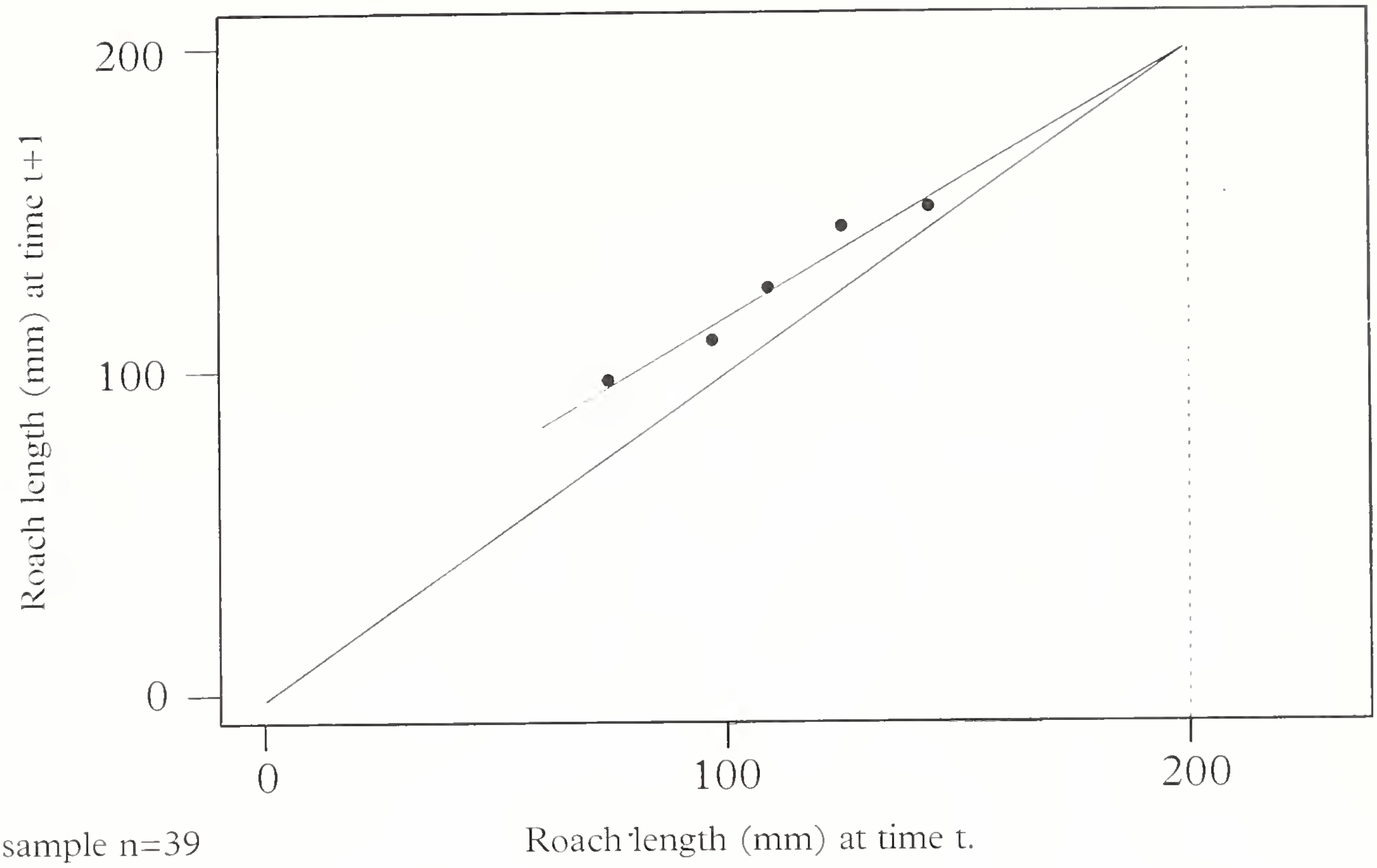

Figure 2:
Walford graph of Buckingham Palace Garden lake roach population.

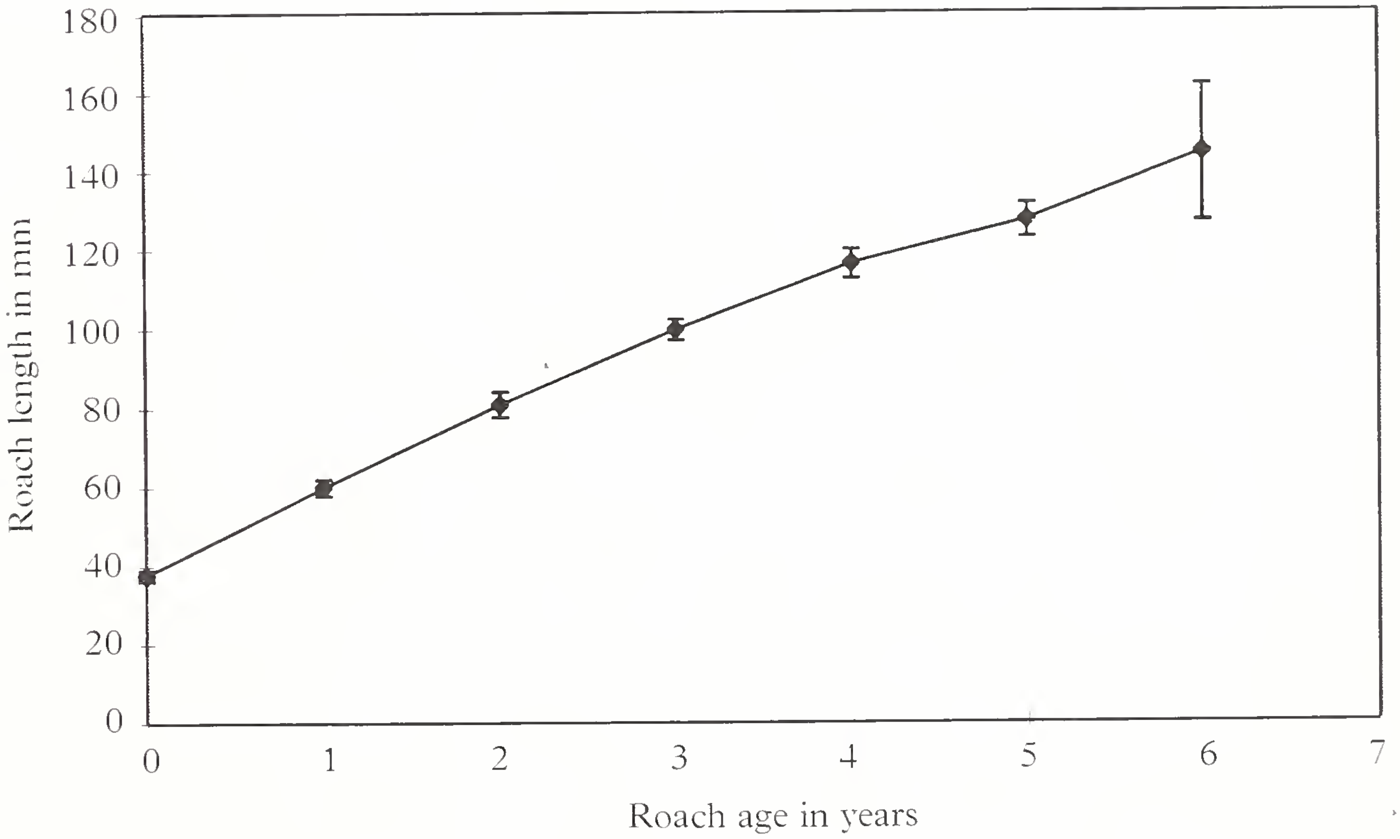

Figure 3a:
Growth curve for roach *R. rutilus* in Buckingham Palace Garden lake.
Mean lengths for each year class are shown ± 95% confidence intervals.

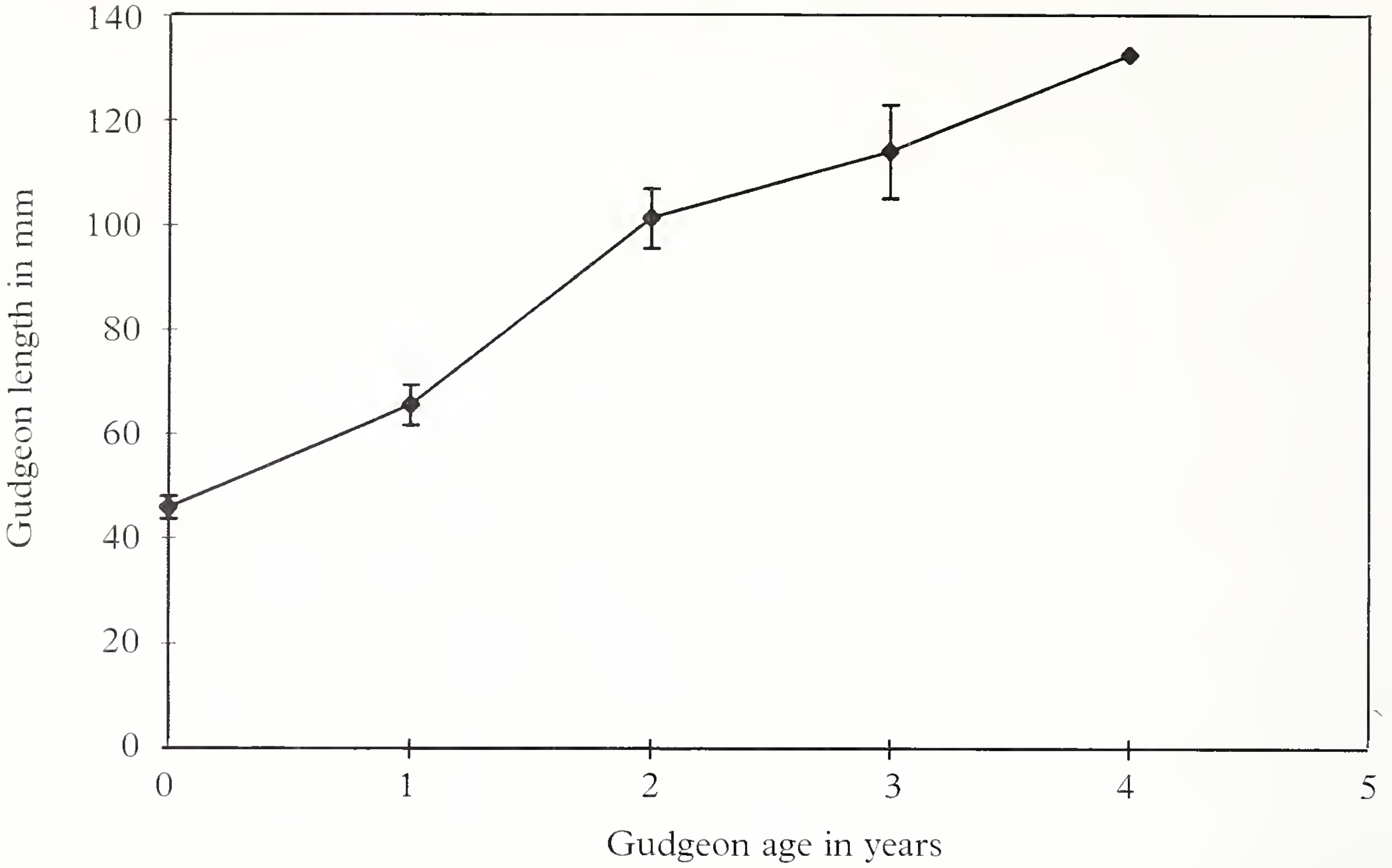

Figure 3b:
Growth curve for gudgeon *G. gobio* in Buckingham Palace Garden lake.
Mean lengths for each year class are shown ± 95% confidence intervals.

The roach is a common member of the carp family found in the majority of waterways of lowland Britain. It is tolerant of a wide range of environmental conditions and is thus found in many different aquatic habitats. It is essentially omnivorous in habit and the size of individuals within a population will be strongly dependent upon the nature and productivity of the environment. The roach in the lake are small in comparison to the length of roach in other habitats such as the River Thames, but not unusually so in comparison with other small, urban lakes (Kett, unpublished data). Comparison with Hickley and Dexter's index of roach growth shows that the roach in the lake grow well in their first year, but that growth rates decline as the fish approach adulthood.

Gudgeon are more usually associated with riverine habitats or gravel-bottomed lakes. Their streamlined shape enables them to maintain their position in running water. They are a small fish, rarely reaching more than 150 mm under optimum conditions. Their presence in the lake is unexpected, bearing in mind the high organic content of the benthic substrate. It is probable that their long-term survival in the lake has been assisted by the water recirculation system and particularly the waterfall where shoals of gudgeon were observed during the electro-fishing survey. Spawning usually takes place in shallow water, over gravel, but in the lake spawning probably occurs at the base of the waterfall where oxygenation levels are highest. The lake probably supplies sufficient benthic invertebrates to support good growth of this species. Their low overall biomass as part of the sample may be a result of under-representation in the seine. Their benthic habit and fusiform morphology mean they were the species most likely to escape the net by slipping underneath it during the haul.

Very few perch were found during the survey and this may reflect the turbid nature of the water within the lake. Perch are predatory fish, feeding on zooplankton in their first year and then macroinvertebrates until they are large enough to be capable of consuming prey such as juvenile fish of their own and other species. Perch are characteristic of slow and still waters where they ambush their prey from stands of vegetation or similar refugia. The low number of perch is probably a consequence of the eutrophic nature of Buckingham Palace Garden lake and interspecific competition with roach for prey. Persson (1987) has shown that roach outcompete perch when foraging for zooplankton, especially when both species are in their first year of growth. Interspecific competition with roach can force juvenile perch to switch to feeding on macroinvertebrates sooner than normal, leading to increased intraspecific competition with older year class conspecifics. Persson & Greenberg (1990) refer to this phenomenon as a 'juvenile bottleneck'. Relatively few perch under these conditions manage to reach a sufficient size to make the change from macroinvertebrates to fish as the main diet component. These factors, together with the lack of macrophytes required for spawning, are likely to have combined to limit successful recruitment within the perch population. This is not an uncommon situation in eutrophic lakes, indeed, Persson (1987) states that under such conditions it is usual for roach to be numerically dominant over coexisting perch.

The previous survey of the Garden reported that the lake supported a population of roach, gudgeon, perch and dace *Leuciscus leuciscus* (Linnaeus 1758) (Evans et al. 1964), but no evidence of the latter species was found by either method of survey. Although absence of evidence is not evidence of absence, the thoroughness of the survey precludes the likelihood of their continued presence in the lake. Dace are characteristic of running-water habitats and, although adaptable, are unlikely to maintain a self-sustaining population under present conditions. It is probable that the common origin of the four species found originally in the lake was the Serpentine, as suggested by Evans et al. (1964). The disappearance of the dace is likely to be due to the isolation of the lake and changes in the nature of the water.

Eutrophication may be a key factor in ordering the composition of fish populations in Buckingham Palace Garden lake. The lack of submerged macrophytes within the lake has already been mentioned, together with the concomitant paucity of macroinvertebrates. These factors, together with abundant waterfowl and the fish, contribute to the summer turbidity of the lake. In non-eutrophic lakes, macrophytes form the major habitat for rich faunas of macroinvertebrates and larger species of planktonic Crustacea, e.g., waterfleas, *Daphnia pulex* (De Geer). Such communities form major prey components of foraging fish (Hulsmann & Mehner 1997). However, dense macrophytes also constitute refugia for invertebrates against fish predation (Moss et al. 1998). Planktonic Crustacea, safe in macrophyte refugia, restrict phytoplankton population growth by filter-feeding (Stephen et al. 1998). Additionally, photosynthesizing macrophytes reduce dissolved plant nutrient concentrations and produce algicidal compounds inhibiting phytoplankton populations (Moss 1980).

These balanced, complex systems are vulnerable to perturbations, ultimately affecting the nature and status of lake fish populations. Such perturbations may have influenced the present state of the lake. Changes were probably gradual; accumulation of debris from surrounding terrestrial vegetation concentrated organic material in the lake as did constant addition of waterfowl faeces. Run-off from surrounding surfaces introduced organic and inorganic nutrients which accumulated in the sediments. Under these conditions, organic materials decomposed, releasing nutrients. Foraging waterfowl and fish disturbed benthic sediment, resuspending nutrients in the water column. Phytoplankton and filamentous algae bloomed, shading and blanketing submerged macrophytes which slowly died. Perch lost spawning substrate and ambush sites. Macroinvertebrates and large zooplankton were deprived of habitat and refuge from fish predation. These processes reduced predation pressure on phytoplankton and increased water turbidity. Further up the food chain, the fish community were affected in other ways. Juveniles grew more slowly as a result of the prevalence of smaller zooplankton species. This increased both competition for, and predation pressure on, the zooplankton community.

The processes operating within Buckingham Palace Garden lake have kept it in a eutrophic state and reduced the diversity, growth and abundance of the fish community. The loss of the dace population was very likely a result of these processes. Eutrophication decreased their foraging efficiency and availability of suitable spawning substrate. Perch are, however, more characteristic of still waters than dace and were probably less disadvantaged by the eutrophication. They persist within the lake, albeit at a low population density, where the dace have, apparently, become extinct. Roach, however, are less disadvantaged under such conditions. They are able to outcompete perch under conditions of eutrophication, being more effective filter feeders on zooplankton and able to subsist, if poorly, on phytoplankton and detritus (Persson 1983). Roach are also more eclectic in spawning substrate, utilising, in the absence of other substrates, tree roots or even stones (Holcik & Hruska 1965). Deprived of weedbeds within which to forage and facing competition from perch for macroinvertebrates and zooplankton, the Palace lake roach increasingly fed by processing benthic silt for the macroinvertebrates living within it. Disturbed silt is soft and flocculant and a poor substrate for macrophyte roots. Badly anchored, shaded and outcompeted by algae, macrophytes were easily uprooted by foraging fish. Of all the fish species within Buckingham Palace lake, roach are hardiest, capable of surviving elevated water temperatures and low levels of dissolved oxygen. The lake is rich in decomposing organic material and exists in the midst of a metropolitan heat island. Oxygen levels are likely to fall in very hot summers, giving roach a vital competitive edge, permitting their domination of the fish community. Perch, gudgeon and dace, and especially their spawn, all require lower temperatures and higher dissolved oxygen levels to thrive.

Such small populations are most vulnerable to random fluctuation in numbers (Williamson 1989). Perch, low in number, outcompeted by roach and short of spawning substrate are the next most likely candidates for extinction under present conditions. The isolation of Buckingham Palace Garden precludes likelihood of natural recolonization, but anthropogenic influence could work to counter the processes that are presently causing deterioration of the lake fish population.

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References

ANON, 1993. *Buckingham Palace*. Headway, Home & Law Publishing Group Ltd, London.

COATS, P. 1978. *The Gardens of Buckingham Palace*. Michael Joseph, London.

COOPER, M. 1991. Stocking and management of the fishery. In Templeton, R., (Ed.) *The creation and management of pond fisheries*: 40–45. Institute of Fisheries Management.

EVANS, J. H., GILCHRIST, B. M. & GREEN, J. 1964. The Lake. In: McClintock, D. C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963: 108.

HICKLEY, P. & DEXTER, K.F. 1979. A comparative index for quantifying growth in fish length. *Fish.Mgmt.* **10:** (4) 147–151.

HOLCIK, J. & HRUSKA, V. 1965. On the spawning substrate of the roach - *Rutilus rutilus* (Linnaeus, 1758) and bream, *Abramis brama* (Linnaeus, 1758) and notes on the ecological characteristic of some European fishes. *Vest.cesk.spol.Zool.* **30**: 22–29.

HÜLSMANN, S. & MEHNER, T. 1997. Predation by underyearling perch (*Perca fluviatilis*) on a *Daphnia galeata* population in a short term enclosure experiment. *Freshwat. Biol.* **38**: 209–219.

MACARTHUR, R. H. & WILSON, E. O. 1967. The theory of island biogeography. MacArthur, R. H. (Ed.), *Monographs in Population Biology*.

MAITLAND, P. S. & CAMPBELL, R.N. 1992. *Freshwater fishes of the British Isles*. HarperCollins

MOSS, B. 1980. *The Ecology of Freshwaters*. Blackwell Scientific Publications

MOSS, B., KORNIJOW, R. & MEASEY, G.J., 1998. The effects of nymphaeid (*Nuphar lutea*) density and predation by perch (*Perca fluviatilis*) on the zooplankton communities in a shallow lake. *Freshwater Biol.* **39**: 689–697.
PAGE, R. 1984. *The wildlife of the Royal estates.* Hodder and Stoughton.
PEACOCK, M. D. 1951. *The story of Buckingham Palace.* Odhams Press Ltd, London.
PERSSON, L. 1983. Food consumption and the significance of detritus and algae to interspecific competition in roach *Rutilus rutilus* in a shallow eutrophic lake. *Oikos* **41**: 118–125.
PERSSON, L. 1987. Effect of habitat and season on competitive interactions between roach (*Rutilus rutilus*) and perch (*Perca fluviatilis*). *Oecologia.* **73**: 170–177.
PERSSON, L. & GREENBERG, L. A. 1990. Juvenile competitive bottlenecks: the perch (*Perca fluviatilis*)-roach (*Rutilus rutilus*) interaction. *Ecology.* **71**(1): 44–56.
RICKER, W.E. 1975. Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. B. Can.* **191**: 1–382.
SLÁDEČEK, V. & SLÁDEČEKOVÁ, A. 1994. Corixidae as indicators of organic pollution. *Freshwater Forum,* **4**(3): 211–213.
STEINMETZ, B. & MÜLLER, R. 1991. *An atlas of fish scales and other bony structures used for age determination: Non-salmonid species found in European freshwaters.* Samara Publishing.
STEPHEN, D., MOSS, B. & PHILLIPS, G. 1998. The relative importance of top-down and bottom-up control of phytoplankton in a shallow macrophyte-dominated lake. *Freshwat. Biol.* **39**: 699–713.
WILLIAMSON, M. 1989. Natural extinction on islands. *Phil. Trans.R. Soc. Lond.* ***B.*** **325**: 457–468.

Amphibians and reptiles in Buckingham Palace Garden

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Abstract

A record of the common frog *Rana temporaria* in Buckingham Palace Garden is given. There are old records of both frogs and the common toad *Bufo bufo* in the Garden, but no other amphibian species and no reptiles have ever been reported here.

Amphibians

The only amphibian noted during the 1995-97 survey of Buckingham Palace Garden would appear to be the common frog *Rana temporaria.*

Frogs have been seen intermittently in the Garden over the past thirty years, though always on land (Mark Lane, pers. comm.). Knight (1964) reported that frogs were very rare in the Garden and listed only a single female found in 1953, adding that no one had ever seen tadpoles or spawn in The Lake. During the 1995-97 survey, single adult frogs were seen on two occasions only, in long grass near The Stoneyard and in grass adjacent to the Back Path, both in the autumn.

The presence of frogs in central London is not a surprise. Langton (1991) remarked that 'In much of urban London you are probably never more than tens of metres from the nearest common frog, making it one of the commonest terrestrial vertebrates and possibly ...... numerically one of the most abundant'. His distribution maps show that the frog was then present throughout much of the urban area of London.

It is difficult to know how Buckingham Palace Garden could sustain a viable breeding population of frogs. The only water where breeding is possible is in The Lake and this is largely devoid of submerged water plants, heavily eutrophic and has a population of predatory fish. No tadpoles have ever been encountered during pond netting or electro-fishing operations and no spawn has ever been seen. Surely the number of frogs seen would be considerably higher if they were breeding here? It is equally hard to believe that a frog migrating back to its natal area might cross one of the busy main roads that surround the Palace and then scale the boundary wall to get to The Lake. Adult frogs live for several years. Langton (pers. comm.) suggests that six years is a good age for a frog though survival to the early teens is possible. Earlier, Burton (1968) suggested that twelve years, in a captive animal, was the record. The notion of a few survivors from an earlier period is possible, though unlikely.

A more interesting possibility is migration of frogs to the Garden via subterranean pipes. The recent report to the London Natural History Society's recorder for amphibians of a frog in an entirely enclosed back yard cesspit in the centre of Soho, gives strong evidence that the animal arrived there via an old, underground sewer, possibly from the Hyde Park area (Langton, pers. comm.). The possibility that frogs gain access to Buckingham Palace Garden by similar means is not one which can be overlooked. It is also quite possible that small frogs could be imported with potted plants or other items on an occasional basis.

The common toad *Bufo bufo*, appears to have been reported once only. Knight (1964) states that one was discovered under a large rock when the cascade was being built. There does not seem to be any other record and The Lake is judged to be entirely unsuitable as a toad breeding site today.

Reptiles

No reptiles of any species were seen during the years 1995 to 1999 in the Garden.

Acknowledgements

I am most grateful to Tom Langton, the London Natural History Society's amphibian recorder, for his comments and advice during the preparation of this short paper.

References

KNIGHT, M. 1964. Amphibians and fishes. In: McClintock, D. C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham palace. *Proc. S. Lond. ent. nat. Hist.* Soc. 1963: 46.

BURTON, M. 1968. *Wild animals of the British Isles.* Warne.

LANGTON, T. 1991. Distribution and status of reptiles and amphibians in the London Area. *Lond. Nat.* **70**: 97 – 123.

Birds in Buckingham Palace Garden

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Abstract

Birds were surveyed in Buckingham Palace Garden from January 1995 to December 1998, though the majority of observations were made in the first three of these years. A total of fifty-eight species was recorded, of which thirty were shown to nest in the Garden at least once during the survey period. A further ten species were free-flying visitors from the wildfowl collection in adjacent St James's Park. A census of breeding species was carried out for the three years 1995 to 1997 and the results are compared with an earlier census from 1961 to 1963. Three species breeding in that earlier period were not found in the Garden during the present survey, whilst eight species that were not recorded in the earlier work were found nesting this time. Possible reasons for the changes are discussed and comparisons drawn between the birds in Buckingham Palace Garden and those in the adjacent Royal Parks.

Introduction and methods

The birds in Buckingham Palace Garden were surveyed on a monthly basis throughout the period 1995 to 1997, with many additional visits made during the nesting seasons. Visits were generally of two-hour duration, but the results were very much dependent on weather conditions, with a certain amount of luck necessary for the observer to gain a few extra species during periods of migration. The winters of 1995–1997 were mild in comparison with those of the 1961–1963 survey and there were no significant hard-weather movements of birds across London. This may explain why some relatively widespread wintering species are absent from the list of birds seen in the Garden.

During the nesting seasons, a Common Birds Census was carried out, to criteria set by the British Trust for Ornithology (Marchant 1983). It was possible to compare the result of the breeding season censuses for 1995–1997 in the Garden with the previous census in 1961–1963 (Cramp and Spencer 1963). It was also possible to compare the results with similar census work carried out in the Inner London* Royal Parks. This produced not only a list of the species nesting, but also an estimate of the densities of breeding birds at each of the locations. The year 1996 was chosen because comparable data were available for all of the parks for that year.

Although the list of species nesting in the Garden has increased over the last 30 years, the overall number of birds present in the breeding season has declined by more than 20 per cent. These findings correlate with comparable survey work in the Royal Parks (Nicholson 1995, Green 1999), and bear disturbing similarities with decreases in bird numbers elsewhere, blamed variously on changing farm practices, pesticides and increases in predators.

Management of the Garden has been extremely beneficial for the birds, with sensitivity by all concerned for the needs of the wildlife.

Systematic list of observations

The majority of these records are for the years 1995 to 1997, when the main fieldwork was carried out, but a few later sightings have also been included. Where appropriate, references have been made to the status of some species in London in order to place the Garden records into context.

Whilst most of the emphasis of the survey was applied to the nesting season, the systematic list covers the whole year and includes birds that wintered in the Garden and also those that passed through here on migration. In the latter category were a few summer visitors rarely seen in Inner London: Turtle Dove, Sedge Warbler, Lesser Whitethroat and Common Sandpiper.

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*The term 'Inner London' as used here with initial capitals, is that first defined by A. Holte MacPherson in 1929 (see Plant, 1987: 7 for details).

Uncommon wintering birds were confined to the lake where Smew and Goosander were seen. Fieldfare and Redwing were absent because the survey was carried out during a succession of mild winters. These species are more usually seen in London when there is prolonged frost or lying snow in the surrounding countryside.

Little Grebe
One on 22 March 1995 and from 7 to 10 March 1996. The last breeding record for the Garden was in 1949. These quite shy birds require a fair amount of nesting cover and are intermittent breeders in Inner London. A pair last bred successfully in St James's Park in 1988 and in Regent's Park in 1994. One or two birds are seen in most years on The Long Water in Kensington Gardens, but there are no breeding records this century.

Great Crested Grebe
A pair nested successfully under an overhanging willow on the small island each year. There were two broods in 1995 and 1997 and all the young fledged. The first successful breeding records for Inner London were in Kensington Gardens and Regent's Park in 1972, where pairs have since nested annually.

Cormorant
Two on 24 April and one on 13 September 1995; singles on 24 April, 12 May and 15 December 1996; singles on several dates in January, April, May and December 1997. Cormorants became regular visitors to The Serpentine in Hyde Park from 1974 and there is now a substantial breeding colony in the Lea Valley in eastern London, where nesting first took place in 1987.

Grey Heron
One was seen in every month during the period of the Garden survey, with two present on 7 April 1997. The species has been seen regularly in Kensington Gardens since 1969. The nearest breeding colonies are in Regent's Park (established in 1968) and Battersea Park (from 1990).

Mute Swan
A pair nested on the main island in 1997 but the birds were continually harassed by Carrion Crows. Eventually they were removed for their own protection to a swan sanctuary. Ring numbers on the swans showed that they had come together in 1996, one from Horley, Surrey, the other from the Thames at Hampton, and they bred successfully in Hyde Park in 1996 before moving to Buckingham Palace Garden on the 17 March 1997.

Greylag Goose
Twenty-six young hatched in 1995 and six in 1997, with nests in the thickest shrubberies. Geese fly in on most days to graze on the main lawn, the largest count being 73 on the 2 December 1996. They are part of a growing population that fly between St James's Park and Hyde Park for much of the year, some dispersing elsewhere to nest. They originate from the wild progeny of naturalized birds, similar to the large flocks now in Kent and other counties. Total numbers in Inner London now exceed 200 birds.

Canada Goose
Nesting took place each year but no young were hatched. As with Greylags, Canada Geese fly in daily to graze on the main lawn, the largest count was 59 on the 16 January 1995. They derive from introductions nearly forty years ago in the Inner London Royal Parks and from naturalized birds from other parts of the London Area.

Mallard
Bred in all three years, with up to ten broods each year. Maxima were 47 birds on 22 February1995; 36 on 8 February 1996; 43 on 20 December 1997, rising to an amazing 94 on 14 January 1998. Botulism accounted for 25 deaths in 1995, when the same bacterium was also prevalent in The Long Water in Kensington Gardens. As there is no expectation of being fed, the tameness of the ducks, so apparent in the Royal Parks, is certainly not shown in the Garden, where they are all quite shy, seldom allowing a close approach.

Shoveler
On the lake between October and March: in 1995 up to three: in 1996 up to 12, and in 1997 up to 14 birds. One in June and July 1995 was probably from the St James's Park collection.

Pochard
There has been a resident population of Pochard in the London Area for some forty years. Migrants from eastern and northern Europe join these in winter. The largest numbers in the Garden were seen between November and March, with 14 on the 18 February 1996. Three were present throughout the summer of 1996, but no nesting was proved. A pinioned pair was released in March 1997. Nestboxes were placed on the island in February 1998.

Tufted Duck
Present throughout the year, the highest count was twenty-four on the 11 March 1996. Breeding took place each year with six broods totalling 34 young, but largely owing to lack of cover, predation was high. A pinioned pair was released in March 1997.

Smew
A female or immature bird was on the lake on 14 January 1998.

Goosander
Two ducks on 21 January 1996. They left when the lake froze over, but four were there on 6 February, with two staying until 11 March. In the following winter one was present from 6 to 12 February and a pair from 7 to 10 March 1997. A drake was seen on 14 January 1998. This is a rare species for Inner London.

Ruddy Duck
One from 1 to 10 June 1996. This seems likely to have been a wild bird as none is kept in the St James's Park collection. This naturalized species breeds regularly at Brent Reservoir and other sites in London including Regent's Park.

Sparrowhawk
During the three years of the survey, a pair of Sparrowhawks nested in a private garden just to the west of Kensington Palace. This resulted in many sightings in the Garden throughout 1996 and 1997, including one of a bird killing a young Woodpigeon in July 1996.

Kestrel
This species has recently become much less common in Inner London, with some of the previously regular nest sites no longer occupied. In the Garden, one was seen occasionally up to June 1995, with three sightings in 1996 and two in 1997.

Moorhen
Two or three pairs nested each year. Up to seventeen birds were present during the autumn and winter months. A list of birds in Buckingham Palace Garden in 1872 showed 30 or 40 Moorhens were present.

Coot
Three or four pairs nested each year. Present throughout the year with the largest counts in March and April, up to 16 in 1996, with fewer birds in the autumn.

Common Sandpiper
A passage bird was noted on 13 August 1997.

Black-headed Gull
Almost all sightings have been of birds flying over the Garden. There are several hundreds in the Inner London parks between September and March, attracted by the ample food supplied by visitors. Movements to and from roosts take place over the Garden each day during that period.

Lesser Black-backed Gull
One over the Garden on 22 March 1995 and on the lake on 21 July 1995. One or two fly over throughout the year, and they are regularly seen on The Serpentine.

Herring Gull
One or two visited the lake area between April and July and they were also seen flying over the Garden throughout the year. Some pairs nest on buildings in north London and around Regent's Park. The Herring Gull is a main predator of ducklings in the Inner London parks.

Common Tern
Two passage birds flew over the Garden on 17 May 1997.

Feral Rock Dove
The feral pigeon of London and other city centres derives from birds which escaped from dovecotes in historic times. These birds are attracted to the parks and squares for food handed out by visitors. In the Garden they are occasionally seen feeding among the grasses near the tennis courts. Up to seven were seen in 1997. Large numbers are in St James's Park all year round and nest on buildings in or near the Garden.

Stock Dove
Two on 18 June 1995 and one on 18 August 1996. A pair was seen displaying for much of April and May 1997 high in plane trees where they may well have nested. This quite secretive species nests regularly in Kensington Gardens.

Woodpigeon
A difficult species to count accurately as they fly around the Garden and in and out of Green Park. Twenty to thirty individuals are probably resident in the Garden. Adults were seen on ten nests in 1996, although which were successful is not known. Young birds that had almost certainly hatched in the Garden were seen in all years.

Turtle Dove
A passage bird was seen on 1 June 1996.

Tawny Owl
All records of sightings are from gardeners and the police. Birds have been heard calling at night and there was one record of an owl on the lawn. In 1997 a nest with eggs was found in a plane tree just outside the wall at Hyde Park Corner. As the branches of the tree, at the time, overhung the Garden, it has been counted as a nesting species for 1997.

Swift
A few can sometimes be seen feeding high over the Garden between June and August. The nearest nest sites are probably on larger, older houses in the Bayswater and Holland Park area.

Kingfisher
One was watched fishing on the lake on 17 June 1998, quite a rare sight in central London. The bird was seen adjacent to an artificial Kingfisher 'bank' or nest site put in place some years ago. A gardener reported a second sighting on 5 August 1998.

Green Woodpecker
In 1997 a pair nested in Kensington Gardens for the very first time. This led to several sightings in Hyde Park and St James's Park. There was one in the Garden on several occasions with five sightings between 27 July and 15 October 1997, and more records into 1998.

Great Spotted Woodpecker
Several observations in 1996 between 21 April and 13 October with drumming heard during the nesting season. There were fewer sightings in 1997, but two were seen on 17 May. At least one bird was in the Garden from April to June 1998. The species began to nest regularly in Hyde Park and Kensington Gardens in 1995.

House Martin
Although House Martins (and Swallows too) migrate across London there were only two sightings during the survey, both of House Martins. Six were over the Garden on the 8 October 1995 and two more on 18 August 1996. The nearest nesting colony of House Martins is under the eaves of the French Embassy and the adjoining building by Albert Gate in Hyde Park. The first Inner London nesting was in 1966, but the species is now in decline.

Grey Wagtail
One seen around the lake on 2 and 9 June in 1995 and 10 and 11 May, 24 June and 17 September in 1997. In 1995 a pair nested at Blackfriars and another pair possibly bred near Regent's Park. Inner London records are rather unpredictable, with most reports being outside the breeding season. Only one to three pairs nest each year in Inner London.

Pied Wagtail
This species was listed among those nesting during the 1961 to 1963 survey of the Garden. Most records this time were of single birds on 25 May 1995 and 7 April, 16 May and 19 June 1997, insufficient to suggest any nesting birds in the vicinity of the Garden. There was an interesting count of 15 birds on 13 September 1995, probably on their way to a nearby roost. An estimated six pairs nest in Inner London but their habit of nesting on buildings may mean several pairs go unreported.

Wren
This is one of the few species to have shown an apparent increase in numbers since the 1961 to 1963 survey. Using the Common Birds Census method, the number of Wren territories was estimated at four in 1995, six or seven in 1996 and five or six in 1997. This compares with only two or three pairs in 1961–62, with probably none nesting in 1963. The Wren is a species very susceptible to harsh weather conditions, a reason put forward for the 1963 failure. Wrens are in the Garden throughout the year.

Dunnock
One or two pairs nested each year, sharply down from five to eight pairs that nested in 1961–62. A similar reduction was noted during census work in Hyde Park and Kensington Gardens, this apparently happening during the 1980s. Birds were seen in the Garden throughout the year, favouring the shrubberies near the eastern end of the mound.

Robin
Between four and eight pairs nested during the survey period, compared with between three and five pairs last time. This increase is in line with similar findings in the Hyde Park and Kensington Gardens censuses. There was a nest with five young in a greenhouse in 1995. Present throughout the year.

Blackbird
Eight to twelve pairs nested each year, slightly lower than in the last survey. These numbers are close to the highest possible for the Garden for this territorial species. Blackbirds can be seen throughout the year in the Garden, but there are fewer in winter.

Song Thrush
The 1961–1963 survey estimated that between five and ten pairs were nesting in the Garden. In 1995, no nesting was proved, with only one or two pairs nesting in 1996 and 1997. This huge reduction reflects the concern nationwide, with the Song Thrush having been placed on a list of endangered species by the Royal Society for the Protection of Birds, and with studies under way to try and establish reasons for the decline in numbers. Outside the breeding season single birds were seen in October 1996 and October 1997.

Mistle Thrush
One or two pairs nested in 1996; one nest was in a Lombardy poplar. The Garden was part of a territory in 1995 and 1997, with the birds flying between the main lawns in the Garden and Green Park. No change in status since the last survey. Birds were present throughout the year.

Sedge Warbler
One was singing in a willow on the island on 1 June 1996.

Lesser Whitethroat
One was seen on 12 May 1996.

Blackcap
One on 24 April 1995. One was singing on 18 June 1995 and 7 June 1997. A male was present in the Garden near the mound from April to June 1998, almost constituting a territory. It was disappointing not to find this species nesting in the Garden. Two or three pairs nest in Hyde Park and Kensington Gardens each year and a pair nested in St James's Park in 1996.

Chiffchaff
Passage birds were noted in 1995 on 24 April, 13 September and 8 October. In 1996 they were recorded on 24 April and in 1997 between 11 and 17 March.

Willow Warbler
One was seen on 13 August 1997.

Goldcrest
Up to two were seen among mixed tit flocks between 16 August and 12 November 1995. One was noted on 13 October 1996, and two on 15 December

1996. In 1997 there was a spring record on 17 March and up to three in the autumn from 6 November to the end of the year. This species first nested in Inner London in 1971. Two pairs nested in Regent's Park in each of the years 1996 to 1998.

Long-tailed Tit
One pair bred each year, favouring the herbaceous border on the north side of the Garden. Outside the nesting season the species tends to feed in small flocks, the largest counts being 18 on 10 September 1996, and 20 on 20 December 1997. This species first nested in Inner London in 1972 and now nests in most of the Royal Parks.

Coal Tit
A pair was seen in 1995, but no nesting proved. The following year, two pairs bred and in 1997 there were two, or possibly three, pairs breeding. The Coal Tit was not nesting in any of the Inner London parks at the time of the 1961 to 1963 survey, but began nesting regularly in Hyde Park and Kensington Gardens in 1966. One or two pairs now also nest regularly in St James's Park. One or two birds can be found in mixed tit flocks at other times.

Blue Tit
A difficult species to census accurately, but up to eleven pairs may have nested in 1996, with perhaps six or seven pairs in 1997. Blue Tits form the largest component of the mixed tit flocks in the Garden during the autumn and winter. A few nest boxes were erected in the Garden in 1998 and were in use the following year.

Great Tit
Between two and four pairs nested each year. One pair used a nestbox and another favoured a lamp-post. Ten recently fledged young were seen on 7 June 1997. Birds are present throughout the year.

Treecreeper
There were four sightings between 8 March and 10 June 1996. One or two pairs now nest regularly in Hyde Park and Kensington Gardens.

Jay
A pair was present throughout the 1996 and 1997 breeding seasons and were apparently carrying food in April 1997. One or two were seen in the Garden regularly through to October 1997 and again in June and July 1998.

Magpie
There were two nests in the Garden each year, with a third nest that may also have been used in 1996. A parliament of 14 was observed in the Garden on 11 March 1996. London was the last major city in the country to be colonized by Magpies and this was in 1971, when pairs bred in Regent's Park and Kensington Gardens for the first time this century.

Carrion Crow
Two or three pairs nested each year. These birds no doubt prey upon the ducklings round the lake and gave the Swans a hard time when they attempted to nest in 1997. Groups of 50 or more have been present in Kensington Gardens since the mid 1960s. In the Garden, an estimate approaching 200 crows in the trees was given to me by one of the Garden staff during 1997. Counts in excess of 30 were seen throughout the study period, with birds flying across to join others in Green Park, open parkland ideally suited to crows.

Starling
One or two pairs nested, with adults seen taking food up into the Palace building. No nests were found in the Garden with few large old trees, other than planes, to provide nesting holes. There has been a dramatic decline in the wintering Starling population in London since the last survey and large roosts of many thousands around Trafalgar Square are now only a memory. Starlings were seen in the Garden only during May and June, with a maximum of 20, apart from two birds in September 1997.

House Sparrow
In 1961–62, an estimate was made of between ten and twenty pairs nesting. During 1995–97, there were only occasional sightings of one or two birds, with no evidence of nesting. The decline of the House Sparrow in London has been documented in regular counts in Kensington Gardens (Nicholson 1995). It is not a new phenomenon, but probably started in the 1940s, although the pace of the decline has quickened recently. There are now only two pairs nesting in St James's Park, where sparrows no longer congregate for a share of visitors' picnics.

Greenfinch
One pair nested in 1996, with recently fledged young seen on 10 June. The only other record was one on the 8 October 1995. Between 10 and 18 pairs nested in the 1961 to 1963 survey. The reduction in breeding numbers has also been observed in Hyde Park and Kensington Gardens and other London parks.

Species of captive origin

In recent years the wildfowl collection in St James's Park has been managed differently. A decision was made about the carrying-capacity of the lake, in terms of numbers of ducks and geese species. To prevent over-capacity, the young of endemic species that are hatched each year are no longer pinioned. This has led to a wide range of wildfowl flying around the lakes of Inner London, often at a time when the truly wild birds would not be seen in London. The following records refer to sightings in Buckingham Palace Garden of birds that originated from the collection in St James's Park.

Bar-headed Goose
One was seen in June 1996.

Barnacle Goose
Up to four were seen every month except July and August, usually grazing with Canada Geese.

Shelduck
Up to seven were seen in 1995, but more usually up to four are present in most months. A pair bred in the Garden in 1996, only three of the nine ducklings survived, the others being eaten by Carrion Crows as they crossed the lawn in an abortive attempt to get to St James's Park. The survivors were taken to St James's Park lake after the adults deserted them.

Ruddy Shelduck
A free-flying bird from St James's Park occasionally joins three pairs of pinioned birds.

Mandarin
A pinioned pair was presented by The Wildfowl & Wetlands Trust in 1997. Palace staff in the Garden reported two free-flying birds in May 1996 which may have been wild. Mandarins now breed in at least eleven sites in the London Area.

Wigeon
Two were seen on 1 June 1996 and one on 15 October 1997.

Chiloe Wigeon
Single birds were noted in June 1996 and in May and June in 1997.

Gadwall
Two observed on 10 May and one on 17 May 1997.

Teal
Two were present from 12 to 19 February 1997.

Pintail
Up to eight were seen each year between January and May.

Pinioned birds

A collection of six pinioned Red-breasted Geese was reduced to one by an urban fox that found a way into the Garden during the autumn of 1995. Later, on 26 January 1996, a fox also killed all eight Flamingoes in The Queen's collection. The Garden has since been made, hopefully, fox-proof! It was decided not to replace the Flamingoes, instead The Wildfowl & Wetland Trust presented Her Majesty with two pairs each of Red-Breasted and Emperor Geese, together with some pinioned ducks in March 1997. More pinioned birds were purchased in 1998 and at the end of that year the collection consisted of five Red-Breasted Geese, two Mandarin Ducks, six Emperor Geese, two Tufted Ducks, six Ruddy Shelducks and two Pochards.

Comparisons with the 1961 to 1963 survey

In the 1995 to 1997 survey, a total of 58 species was observed in the Garden (discounting collection species), compared with a total of sixty species observed in the 1961 to 1963 survey.

Notable differences between the surveys were the absence from the later work of wintering Redwing and Skylark and fewer passage species such as Cuckoo, Swallow, Sand martin, Wheatear, Whitethroat, Pied Flycatcher and Garden warbler, which were all seen in the 1961–63 period. It is thought that the present species list might have been increased had more early morning visits been made to the Garden during spring and autumn migration months.

The increase in species in the 1995–97 survey is mainly accounted for in an increase in nesting species.

Nesting species 1995–97

Some thirty species were recorded nesting in Buckingham Palace Garden during the 1995 - 1997 survey. These are listed in Tabie 1, which also shows the number of breeding pairs and gives comparative figures for the 1961 to 1963 survey.

The estimates for the number of song birds present during the nesting season were achieved through a Common Birds Census (Marchant 1983). During each visit, between March and July, the observer mapped all singing birds. Additional records of bird behaviour, such as birds carrying nesting material or food were also mapped. At the end of the breeding season the maps for each visit were analysed and conclusions drawn about the sizes and numbers of territories held by each species. Visits for a census of this kind are best in the early morning and evening when most birdsong can be heard. For the Garden, weekends are preferable when there is much less traffic noise.

Inevitably, territories for some species were quite large and only partly within the Garden. Mistle Thrush is an example of that, with some birdsong and feeding taking place across the wall in Green Park. By contrast, Wren and Robin territories were compact, with several pairs nudging together along the herbaceous border and male birds singing strongly to defend their territory from neighbours.

Similar censuses have been carried out in Hyde Park and Kensington Gardens. First over a 14-year period from 1967 to 1980 and more recently between 1994 and 1997. These censuses give a useful comparison with Buckingham Palace Garden and confirm that the fall in numbers of birds nesting is not confined to the Garden.

TABLE 1. Breeding bird species in Buckingham Palace Garden: estimates of the number of breeding pairs or birds holding territory for the years shown.

Species	**Year**				
	1961	**1962**	**1995**	**1996**	**1997**
Great Crested Grebe	—	—	1	1	1
Mute Swan	—	—	—	—	1
Greylag Goose	—	—	6	4-6	6
Canada Goose	1	1	6	4	4
Mallard	20-25	25-30	10	5	5-6
Pochard	1	1	—	1	—
Tufted Duck	10-12	10-14	2	3	6
Moorhen	4-5	5-8	3	2-3	2-3
Coot	4	4	3	4	3
Stock Dove	—	—	—	—	1
Woodpigeon	20-25	20-30	6-8	8-10	5-8
Tawny Owl	1	—	1	—	1
Great Spotted Woodpecker	—	—	—	1	—
(Pied Wagtail)	2	2	—	—	—
Wren	2-3	2-3	4-5	6-7	5-6
Dunnock	5-7	5-8	1-2	1-2	1-2
Robin	4-5	3-4	4-5	7-8	5
Blackbird	10-15	10-15	8-9	12	8-9
Song Thrush	8-10	5-6	—	1-2	1
Mistle Thrush	1	1	1	1-2	1
(Spotted Flycatcher)	2	2	—	—	—
Long-tailed Tit	—	—	1	1	1
Coal Tit	—	—	1	2	2-3
Blue Tit	3-4	4-6	4-6	10-11	6-8
Great Tit	2-3	2-3	2	3-4	2-3
Jay	1	1	—	1	1
Magpie	—	—	2	2-3	2
Carrion Crow	1	1	2	2	2-3
Starling	7-9	8-10	—	1-2	1
House Sparrow	5-10	5-10	1	1	1
(Chaffinch)	2	1-2	—	—	—
Greenfinch	5-7	7-9	—	—	—
Feral Rock Dove	—	—	1-2	1-2	1-2
Estimated total pairs	121-156	125-171	70-79	86-101	75-89
Number of species present each year	25	25	22	27	27
Total number of species	25			30	

Comparisons with 1961–63 breeding bird data

Compared with the previous survey in 1961–63 there have been eight additions and three deletions from the twenty-five species that nested then. These are summarized in Table 2.

TABLE 2. Gains and losses in breeding birds at Buckingham Palace Garden between the two surveys.

Gains	Losses
Mute Swan	Pied Wagtail
Great Crested Grebe	Spotted Flycatcher
Greylag Goose	Chaffinch
Great Spotted Woodpecker	
Stock Dove	
Long-tailed Tit	
Coal Tit	
Magpie	

The changes are remarkably similar to what has been observed in the Royal Parks over the same period. In fact only two species, Chaffinch and Blackcap, now breed in the Royal Parks but not in Buckingham Palace Garden. One other species, the Spotted Flycatcher, no longer nests in the Garden and has similarly been lost as a breeding species in Regent's Park and Kensington Gardens, with just one pair nesting in Hyde Park in 1998. The comparative densities of the breeding populations in the two surveys are shown in Table 1.

The top ten species for the two surveys arrived at by averaging the annual estimates of breeding pairs are shown in Table 3. Only four of the most numerous species in the 1961 to 1963 survey are still on the list today: Mallard, Woodpigeon, Blackbird and Tufted Duck. With the exception of Moorhen, the remaining species on the 1961-62 list were represented by only one or two pairs in the 1995 to 1997 survey.

The Starling count was down from between seven and ten pairs in 1961–62, House Sparrow and Song Thrush down from between five and ten pairs, Greenfinch down from between five and nine pairs and Dunnock down from between five and eight pairs. Overall the number of birds nesting in the Garden was down from between 121 and 171 pairs in the 1960s to between 75 and 101 pairs in the 1990s. This represents a significant reduction in the density of the breeding population over the last thirty years.

TABLE 3. The 'top ten' breeding species, presented in decreasing numerical frequency, at Buckingham Palace Garden.

1961 to 1962 Survey	1995 to 1997 Survey
Mallard	Blackbird
Woodpigeon	Woodpigeon
Blackbird	Blue Tit
Tufted Duck	Mallard
Starling	Robin
House Sparrow	Greylag Goose
Song Thrush	Wren
Greenfinch	Canada Goose
Dunnock	Tufted Duck
Moorhen	Coot

Comparison with Inner London Royal Parks

At the time of the 1961 to 1963 survey, estimates of the breeding population of birds in the Royal Parks were only available for Regent's Park (Wallace 1961). By comparing the estimates of breeding birds for the Garden and Regent's Park, the conclusion is reached that the density of breeding birds in the Garden was more than three times higher than for Regent's Park and Primrose Hill. Those densities were arrived at using total acreage for the Park and Garden, assuming that both had an almost equal proportion of open grassland unsuitable for nesting sites. Freedom from disturbance was thought to be the most important factor determining the higher density of breeding birds in the Garden. In 1961–62 the densities found for the Garden and Regent's Park were between 61–88 birds per ten acres and 19-22 birds per ten acres respectively. Expressed using the metric system, this equates to:

Density in Buckingham Palace Garden —1961–62	15-21 birds per hectare
Density in Regent's Park — 1959	5 birds per hectare

Using 1996 data for nesting birds, the revised densities for the Garden and Regent's Park are:

Buckingham Palace Garden	11–12 birds per hectare
Regent's Park	4 birds per hectare (Green 1997)

Both areas show a reduction in excess of 20 per cent in bird densities over the last thirty years, but the higher density of birds in the Garden remains at around three times that of Regent's Park.

The survey report for Buckingham Palace Garden for 1961–63 also referred to birds breeding in the Inner London Royal Parks at that time. Comparing that list with the species breeding in the parks in 1996, it is apparent that the changes since the 1960s are remarkably similar to those which have occurred in the Buckingham Palace Garden over the same period.

The following species, added to the breeding bird list in the Garden since the 1961 to 1963 survey, were also added as new breeding species to some of the Royal Parks:

Mute Swan (all parks)
Great Crested Grebe (all parks except St James's Park)
Greylag Goose (all parks)
Great Spotted Woodpecker (all parks except St James's Park)
Stock Dove (Kensington Gardens and Regent's Park)
Long-Tailed Tit (all parks)
Coal Tit (all parks)
Magpie (all parks)

Other changes since the early 1960s are not yet reflected in the Garden list. Blackcap, for example, now nests regularly in St James's Park and Regent's Park and might reasonably be expected to do so at Buckingham Palace Garden. House Martins moved into a cleaner Inner London in 1966 and now nest on the French Embassy at Albert Gate (Hyde Park). The eaves of Buckingham Palace would surely make an excellent nesting site!

Three birds were lost as breeding species for the Garden. The Chaffinch was a probable nesting species in the Garden in 1961–63, but was not seen at all during the 1995 to 1997 survey. It was recently added to the breeding list for St James's Park and now nests in all of the Royal Parks, although in relatively small numbers. Spotted flycatcher has also been lost as a breeding species in Kensington Gardens and Regent's Park, with just one pair holding on in Hyde Park. The Pied Wagtail has never been a regular nesting species in the Royal Parks, preferring to nest on buildings where a few pairs probably go unrecorded each year. One of the two pairs to nest in the Garden during 1961 reared young in an open flower vase on the terrace.

In summary, the changes noted in the bird species nesting in Buckingham Palace Garden over the last thirty years are similar to the changes observed in the Inner London Royal Parks. Of the breeding list for the Royal Parks, only Blackcap and Chaffinch might reasonably be expected to be found at Buckingham Palace Garden.

For 1996, data are available for the numbers of birds nesting in all of the Royal Parks of Inner London. This gives a unique opportunity to compare not only the species nesting in the Garden, but also the total numbers of birds at each site. Tables 4 and 5 show the number of breeding pairs in Buckingham Palace Garden directly compared with St James's Park, Hyde Park, Kensington Gardens and Regent's Park in the 1996 breeding season. Table 4 lists water birds and wildfowl; Table 5 lists land birds and passerines.

The Garden has the highest density of wildfowl, with St James' Park and Regent's Park close behind. The list (Table 4) excludes wildfowl collections, on the assumption that these birds are fed daily and are not dependent on the lake for food.

Availability of undisturbed nest sites is a significant factor in determining the density of wildfowl in these areas. Hyde Park has the lowest density, since the only nest site available is the Serpentine Island, where even the shy Great Crested Grebe nests successfully in a small area closed to boating. Some wildfowl require tree-holes in which to nest and there are few suitable trees in Hyde Park.

Numbers of birds in both St James's Park and Regent's Park are high, with the islands well maintained for the birds and ample food and plenty of nest-boxes providing ideal conditions for both wild and feral populations alike to nest.

TABLE 4. Breeding water birds and wildfowl in Buckingham Palace Garden and the Inner London Royal Parks in 1996. The totals exclude the wildfowl collections in St James's Park and Regent's Park.

Species	**Location**				
	Buckingham Palace Garden	**St James's Park**	**Hyde Park**	**Kensington Gardens**	**Regent's Park**
Grey Heron	—	—	—	—	20
Great Crested Grebe	1	—	1	—	7
Mute Swan	—	1	1	1	1
Greylag Goose	4-6	2	2	—	2
Canada Goose	4	2	26	4	6
Mallard	5	15	2	5	26
Pochard	1	10	7	3	12
Tufted Duck	3	20	2	12	10
Moorhen	2-3	6	2	3	12
Coot	4	7	2	5	14
Nesting pairs	24–27	63	45	33	110
Total water birds	48–54	126	90	66	220
Area of lakes (hectares)	1.6	4.6	11	4	8
Water birds per hectare of water	30–34	27	8	17	27

Buckingham Palace Garden has by far the smallest of the lakes, but nevertheless hosts a wide range of wildfowl, whilst the lack of disturbance increases the number of nesting sites, albeit no artificial food was provided in 1996.

A small collection of pinioned ducks and geese was introduced to the lake in 1997 with some artificial food now being provided in winter. It will be interesting to see if this extra food attracts more wildfowl to nest in the Garden. A few duck-boxes have recently been placed on the island.

Wildfowl numbers, however, can be misleading when it comes to comparisons between sites. In St James's Park, for example, there are about 150 wildfowl in the collection, the majority of which are pinioned. Many nest each year, but the offspring are no longer pinioned and when fully fledged some leave the park, with a few visiting Buckingham Palace Garden. Ringing has shown that some young birds disperse over a wide area, with recoveries from Kent, Norfolk, and northern France. The carrying-capacity on St James's Park lake is largely determined by the amount of artificial food and suitable nesting sites provided by the bird-keeper. The lake is, therefore, managed; the same is true for Regent's Park.

Turning to the land birds and passerines, Table 5 shows the numbers of breeding pairs or territories in Buckingham Palace Garden compared with similar data for the parks. Green Park is excluded as it has no shrubberies and very few birds except those nesting in gardens along its eastern boundary. The trees are mostly mature London plane, which tend to be shunned by the birds. Its open grassland provides a feeding ground for large numbers of Crows and Magpies that move in to Buckingham Palace Garden when the park gets busy.

Approximately half the species require shrubberies for food and nesting sites, while the remainder tend to nest high in the trees, in tree-holes, or on buildings. The breeding population of the Garden, excluding the water birds, is between 61 and 72 pairs, giving a density of between eight and ten birds per hectare. This is much higher than for all of the Royal Parks except St James's Park, which has a density of eight birds per hectare. Although the larger parks have a lower density of birds compared with the Garden, perhaps disturbance from the public is not a major factor. After all, the number of visitors walking through St James's Park is enormous, and yet the number of birds is almost as high as in the Garden.

Approximate areas of shrubberies at each site are as follows:

Buckingham Palace Garden	3 hectares representing 20 per cent of total site area
St James's Park	2 hectares representing 11 per cent of total site area
Hyde Park	4.4 hectares representing 3 per cent of total site area
Kensington Gardens	4.2 hectares representing 4 per cent of total site area
Regent's Park	3 hectares representing 2 per cent of total site area

This shows that the area given over to shrubs is much greater in St James's Park and Buckingham Palace Garden than in the larger parks. The shrubberies in the parks are enclosed and are usually free of disturbance. Birds would be able to feed throughout the parks in the early mornings and evenings, retreating to the seclusion of the shrubberies when the throng of visitors arrives.

From this evidence it would appear that it is the presence of undisturbed shrubberies, with suitable cover for nesting, feeding and roosting, that may control the number of birds, rather than whether the whole area is quiet and secluded. Having said that, even the Garden is full of visitors on occasions when thousands of people attend garden parties in the summer. By then most of the nesting has been completed.

TABLE 5. Breeding land birds in Buckingham Palace Garden and the Inner London Royal Parks in 1996: estimates of breeding pairs.

Species	**Location**				
	Buckingham Palace Garden	**St James's Park**	**Hyde Park**	**Kensington Gardens**	**Regent's Park**
(i) Mainly shrub-dependent species					
Goldcrest	—	—	—	—	2
Wren	6–7	7	5	6	12
Dunnock	1–2	2	3	3	16
Robin	7–8	9	11	20	18
Blackbird	12	12	26	38	15–18
Song Thrush	1-2	4	6	5	8–10
Blackcap	—	1	2	3	5–7
Spotted Flycatcher	—	—	1	—	—
Long-tailed Tit	1	2	2	3	3
Coal Tit	2	2	1	2	1
Blue Tit	10–11	9	16–19	18	15–20
Great Tit	3–4	4	7	15	8–10
Chaffinch	—	2	1	2	6
Goldfinch	—	—	—	—	1–2
Greenfinch	1	1	5	1	1
(ii) Species largely dependent on mature trees or buildings					
Woodpigeon	8–10	7–10	5–10	15–20	15
Stock Dove	—	—	—	3	3
Tawny Owl	—	—	1	1	3
Great Spotted Woodpecker	1	—	1	1	1
Sparrowhawk	—	—	—	—	1
House Martin	—	—	8	—	—
Kestrel	—	—	—	—	3
Mistle Thrush	1–2	1	5	4	8
Nuthatch	—	—	—	1	—
Treecreeper	—	—	1	1	—
Jay	1	—	1	1	3–4
Magpie	2–3	1	6	6	14–16
Crow	2	1	3–4	7	15–20
Starling	1–2	5–8	15–20	20–25	10–15
House Sparrow	1	3	20	40	8–12
Total pairs	61–72	73–79	152–166	216–226	195–227
Number of birds	122–144	146–158	304–332	432–452	390–454
Total area in hectares (excluding lakes)	14.5	18.7	146	112	164
Birds per hectare	8.4 – 9.9	7.8 – 8.4	2.1 – 2.3	3.9 – 4.0	2.4 – 2.8

Natural food availability and suitable cover for nest sites largely influence the numbers of birds at each site. This should answer the question as to whether the relatively undisturbed Buckingham Palace Garden is more desirable to nesting birds than the Royal Parks with their human pressures. Kensington Gardens has a higher density of birds than the adjoining Hyde Park, despite having a similar proportion of shrubberies. This can be explained by the different character of the two parks. There are a greater variety of mature trees in Kensington Gardens, most of which are native trees with a canopy covering 42 per cent of the park. This offers opportunities for woodland birds such as Stock Dove, Nuthatch and, in 1997, the newly arrived Green Woodpecker, to gain a foothold. In Hyde Park by contrast, since the loss of the elms in the 1970s, the majority of the mature trees are London planes, which are low food-providers for birds, and the canopy cover is only 23 per cent.

Conclusions

The study has shown that the size of Buckingham Palace Garden, at just sixteen hectares, is sufficiently large to monitor much of what is happening to the bird life throughout Inner London.

Changes in the species nesting in the Garden since the last survey in the 1960s almost exactly mirror the changes that had been observed in the much larger Royal Parks over the same period.

More surprising is the correlation of overall bird numbers. At one time it was thought that London's birds were somehow immune from what was happening in the countryside. Recently, falls in the numbers of some species nationwide have been shown to affect the London populations too.

Of particular concern is the decrease in numbers of what were regarded as common birds. Starling and House Sparrow were so common that very little is known about them. Few people bothered to record them. Studies like this can highlight these dramatic changes at an early stage.

This study has shown that the numbers of birds appear to be influenced not so much by the number of visitors, but more by the availability of undisturbed shrubberies and mature native trees. While little can be done to prevent the loss of species that are declining nationally, it is possible by continuing good management of the trees and shrubs, to create habitats that will encourage a greater variety of species to nest. Emphasis should be directed towards maintaining areas of dense cover in each of the shrubberies. The inclusion of hawthorn would be advantageous, both for cover and as a winter food source. Tree plantings should be confined as far as possible to native species that support the largest number of insects. The eventual replacement of the London plane, which originated in the Lebanon, and supports just one or two species of insect in this country, with native oaks, which support over 280 sspecies of insects, would in the long term be beneficial to all wildlife.

The Garden is a wonderful haven for wildlife. Even though there is no species nesting in the Garden that cannot be found elsewhere in London, the density of wild birds is probably higher than anywhere else in the capital.

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References

CRAMP S. and SPENCER R. 1963. Birds. In: McClintock, D.C., Richards, O.W. and Knight, M., Natural History of the Garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.*, 1963: 40–45.

GREEN R.C. 1999. *The Birds of Regent's Park to 1996*. Royal Parks Agency.

MARCHANT, J. 1983. *BTO Common Birds Census instructions*. British Trust for Ornithology.

NICHOLSON E.M. 1995. *Bird-watching in London*. London Natural History Society.

OSBORNE K.C. 1997. The breeding birds of Inner London 1970–95. *London Bird Report* **61**: 190–210.

PLANT, C.W. 1987. Recording London's wildlife (Presidential Address delivered at the Annual General Meeting on 9 December 1986). *The London Naturalist* **66**: 7–12.

Mammals in Buckingham Palace Garden

CLIVE HERBERT

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Abstract

The occurrence of six mammal species in Buckingham Palace Garden is documented. Comments are made on their status in the Garden and on the completeness of the recording effort.

Methodology

Mammals in Buckingham Palace Garden have been recorded using three survey techniques. A dusk visit to the Garden was made on 2 July 1996 and bats were recorded during optimal weather conditions for foraging using a standard 'Bat Box III' heterodyne bat detector. Secondly, the small terrestrial mammal population was surveyed during the night of 18/19 March 1998 using a total of forty standard Longworth live traps which were set in a variety of suitable habitats within the Garden. Finally, a number of casual observations, made in the years since the previous survey (Corbet 1964) were obtained verbally from Mark Lane, the Head Gardener.

The main constraint on the survey relates to the small-mammal trapping. This was undertaken at a time of the year when populations had decreased from their late-autumn peak and it is likely that some species may not have been encountered simply because they were present only in small numbers. Regrettably, there was no subsequent trapping in order to detect these species at a later date.

Survey results

The bat survey recorded several pipistrelles around the lake and occasional individuals elsewhere in the Garden. The work was undertaken before the pipistrelle was confirmed as two cryptic species (Barrett et al. 1997) which can usually be separated in the field on the basis of their peak echolocation frequency at either 45 or 55 kHz. During the survey, occasional encounters with individual bats were, however, too brief and too infrequent to be confident about whether a single species or both were present.

Small-mammal trapping resulted in the capture of only wood mice, with a total of six male, four female, three juvenile and one unsexed individual being recorded. This corresponds to a trap occupancy rate of 35 per cent.

A further four species, grey squirrel, house mouse, common rat and fox, were recorded by casual observations.

A final species, the field vole, which had been claimed independently by two observers in 1961, was rejected by G. B. Corbet when summarising the results of the original survey (Corbet 1964) and has never been reported since that date. The present author supports its exclusion from the species list given below.

Discussion

The six species of mammal reliably recorded from Buckingham Palace Garden compares with a total of 49 species (excluding pinnipeds and cetaceans) currently on the London Area list (Herbert 1996). There are no unexpected records and the list compares somewhat unfavourably with other urban open spaces, such as Hyde Park and Holland Park. Both of these two sites have additional species present, including hedgehog *Erinaceus europaeus*, noctule *Nyctalus noctula* and introduced rabbits *Oryctolagus cuniculus*, as well as resident populations of species which have only an occasional status in the Garden. The fox and common rat fall into this latter category. The lack of ground cover in the Garden, together with the difficulty in colonisation, may also prevent other small mammal species from becoming established.

It is considered that a more extensive trapping programme would have confirmed the continuing presence of house mouse and further attention to the low numbers of bats present may result in confirmation that both pipistrelle species occur here. With these exceptions, however, it is considered that the full mammal fauna of the site has now been documented.

The only mammal present in the garden of conservation significance is the pipistrelle which is a National Biodiversity Action Plan species and is included in the *Red Data Book* by Morris (1993) along with all other British bats.

Species list

A total of six mammal species has been reliably recorded from the Buckingham Palace Garden. The nomenclature follows Corbet and Harris (1991). Species recorded in the previous survey, but not found in the present study, are shown enclosed in round brackets.

CHIROPTERA

Vespertilionidae

Pipistrelle *Pipistrellus pipistrellus*

Small numbers of this bat, which has subsequently been separated into two species, have been recorded foraging in the Garden. Its occurrence there was correctly anticipated by G.B. Corbet when he summarised the mammals recorded during the earlier survey (Corbet 1964).

RODENTIA

Sciuridae

Grey squirrel *Sciurus carolinensis*

This species is present all year. It sometimes nests in the Garden and individuals are also reported to move in from nearby Green Park (M. Lane, pers. comm.).

Muridae

[Arvicolinae]

[Field vole *Microtus agrestis*

A 1961 record of this species from the Garden is considered unreliable and was rejected by Corbet (1964). No new evidence has come to light to disagree with Corbet's opinion.]

Murinae

Wood mouse *Apodemus sylvaticus*

The most numerous small mammal in the Garden, where it is present in good numbers.

(House mouse *Mus domesticus*

This species was one of only two mammal species confirmed as being present in the Garden during the 1961–63 survey. It was not recorded during trapping in 1998, and the only records available are the observations of Head Gardener Mark Lane from a few years earlier than this. There is no reason to suppose that it is no longer present and any future survey in an appropriate season is likely to turn it up.)

(Common rat *Rattus norvegicus*

This species was also recorded during the earlier survey when it was thought to occur as an occasional immigrant, and was quickly eliminated. Since that first survey, one individual was recorded during the mid 1980s (M. Lane, pers. comm.) when it was observed digging up tulip bulbs and found to be nesting at the back of the Rose Garden.).

CARNIVORA

Canidae

Fox *Vulpes vulpes*

This species is widespread throughout the surrounding area of central London and occurs in the Garden as an occasional immigrant, which is then actively deterred to prevent breeding (M. Lane, pers. comm.). One individual made the national news in 1996 when it killed the flamingos kept on the lake (R. Sanderson, pers. comm.).

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The field work for this paper was undertaken by Charlotte Aybes of Amphibian, Reptile & Mammal Conservation Ltd (small mammal trapping) and the author (bats).

References

BARRETT, E.M., DEAUVILLE, R., BURLAND, T.M., BRUFORD, M.W., JONES, G., RACEY, P.A. & WAYNE, R.K., 1997. DNA answers the call of pipistrelle bat species. *Nature* **387**: 138–139.

CORBET, G.B. (1964) Mammals. In: McClintock, D.C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.*, 1963: 39.

CORBET, G.B. & HARRIS, S. (Eds.), 1991. *The handbook of British mammals.* (Ed. 3). Blackwell, Oxford.

HERBERT, C., 1996. A check-list of the mammals of the London Area, 1900–1994. *Lond. Nat.* **75**: 91–94.

MORRIS, P. A., 1993. *A Red Data Book for British mammals.* The Mammal Society, London.

PLATE B. Buckingham Palace Garden, London. View from Mudhole, looking across The Lake towards the Rose Garden, summer 1998. *Photographed by Mark Lane.*

The molluscan fauna of Buckingham Palace Garden

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Abstract

Between March 1996 and May 1998, a study was made of the molluscan fauna of Buckingham Palace Garden. Sixteen terrestrial species and five freshwater species of gastropods were recorded. The alien slug *Lehmannia valentiana* (Férussac, 1823) was recorded living in the open. The factors influencing distribution within the habitat are considered, as are those which may influence the constituent taxa within the assemblage.

Introduction

The data upon which this paper is based resulted from visits to Buckingham Palace Garden by myself and my wife on 18 March, 20 May, 30 September 1996 and 3 September 1997, together with material passed to me by Alick Henrici, Mark Lane and Colin Plant. Mary Spencer-Jones supplied some records of *Bithynia tentaculata* and *Planorbarius corneus*.

Materials and methods

The majority of the terrestrial gastropods were recorded by searching suitable habitats within the Garden, and by collecting leaf-litter and soil for drying and sieving later through nylon mesh sieves with mesh apertures of 2 mm and 0.5 mm. Recording was considered complete for the visit when no new species were found after a minimum of thirty minutes additional searching. A few specimens were collected from pitfall-traps set to collect other groups, or were found during field work by others, and these were forwarded to me for identification and inclusion in the records.

The freshwater species were recorded by collecting from the bank of The Lake using a 25 cm diameter nylon mesh scoop, with a mesh aperture 0.5 mm, on a 1.5-metre aluminium pole. The contents of the scoop were examined in fresh water in a shallow white dish. Also, samples of water weeds were collected, washed with fresh water and the washings examined in a shallow white dish. Recording was considered complete for the visit when no new species were found after a minimum of thirty minutes additional searching.

All records included the local grid reference and details of the habitat.

Results

A total of eighty-five specimens of molluscs was collected in the Garden, representing twenty-one species; sixteen terrestrial and five freshwater species. Details are summarised in Table 1.

Discussion

Terrestrial species

Approximately 125 terrestrial species of molluscs are currently recognised as occurring naturally in Britain (Kerney 1976b).

Whilst not analogous to a woodland, the large mature garden may be compared to one when considering the molluscan fauna since it contains many similar elements, including mature trees, an under-storey of shrubs and some ground cover, even if the flora is composed mainly of introduced species and cultivars. Buckingham Palace Garden also includes a large expanse of closely mown lawn, but none of the molluscs recorded in the present study as found within the area of the lawn, and so it seems reasonable to discount it for present purposes. However, it does cover a large area and exposes the surrounding beds and borders to the drying effects of the wind, a factor which will be referred to again.

TABLE 1. Summary of numbers of specimens of species recorded and habitats in which they were found.

Species	**Number of specimens**	**Habitat**			
		Under wooden sleepers, planks or flower pots	**In leaf litter or soil**	**In lake**	**Other**
Aegopinella nitidula	1		1		
Arion hortensis	5		5		
Arion intermedius	2		2		
Bithynia tentaculata	9			9	
Cepaea hortensis	1				1
Deroceras reticulatum	2		1		1
Ferrissia wautieri	3			3	
Gyraulus albus	7			7	
Helix aspersa	10		8		2
Hippeutis complanatus	1			1	
Lehemannia velentiana	14	12			2
Limax flavus	2	2			
Limax maximus	1				1
Oxychilus alliarius	1	1			
Oxychilus cellarius	13	3	8		2
Oxyloma pfeifferi	1				1
Planorbarius corneus	1			1	
Punctum pygmaeum	2		1		1
Tandonia sowerbyi	5	3	2		
Testacella scutulum	1	1			
Vitrina pellucida	3		3		
Totals	**85**	**22**	**31**	**21**	**11**

Some of the most species-rich sites for terrestrial molluscs are woodlands in north-east England, containing some nationally scarce species, and which have a mean number of species per site of 29.06 ± 1.49; range 19 to 39 (Wardhaugh 1996). In that study, species richness was shown to be positively associated with woodland area, moisture level and age. The association of species-rich mollusc faunas with alkaline soils is well known (Boycott 1934), although it is clear from more-recent studies that it is the availability of calcium salts in the leaf litter rather than the alkalinity of the soil which is important (Wäreborn 1969, Bishop 1977).

In the south of England species-rich sites may be found on the scarp slopes of the South Downs. Thirty-six species were recorded at such a site in West Sussex (Willing 1986).

Only sixteen terrestrial species were found on the site in the present study, and with eight of these being slugs, Buckingham Palace Garden must be considered a relatively poor site for molluscs. The possible reasons for this will be considered later in this article.

Castell (1962) provides a historical overview of molluscs of the London area, but adds little to our understanding of the ecology of molluscs in an urban environment. Six of the sixteen species recorded in the present study, namely *Arion hortensis*, *Tandonia sowerbyi*, *Limax maximus*, *L. flavus*, *Testacella scutulum* and *Helix aspersa* are included by Boycott (1934) in a group as associated with houses and gardens. Although they were not found during this study, the previous survey (Bristowe 1964) recorded *Oxychilus draparnaudi* and *Tandonia budapestensis*. Both of these are also included in Boycott's group of molluscs associated with houses and gardens. To this assemblage we may add *Lehmannia valentiana*. This species has been known in Britain as a greenhouse alien for some time. It originates from the Iberian peninsula and was first found in the British Isles in the Botanical Gardens at Belfast in 1948 (Quick 1960, referred to as *Limax poirieri*). It has only very occasionally been found living in the open as an escape (Kerney and Cameron 1979). During the present study it was found on each occasion the site was visited, in widely scattered localities, and at a frequency of from one to four individuals at each locality, suggesting it is firmly established in Buckingham Palace Garden. It has since been found living in the open at a few sites in Somerset (Buckle 1998) and it has also been reported from a garden in Woking, Surrey (Nelson pers. comm.).

The absence of *Oxychilus draparnaudi* and *Tandonia budapestensis* from the present study may be explained by their 'transitory' nature. From observations in my own garden, they occur for a year or two, are not seen for several years and then come back again, without any obvious reason.

Locations of terrestrial species within the Garden

Boycott (1934: 8) is of the opinion that the main considerations are shelter and lime, and defines shelter as 'such conditions as secure damp air and provide nooks and crannies into which Mollusca can retire to escape drought and cold and lay their eggs.' The data obtained in this study, although insufficient to warrant statistical analysis, tend to support the view that shelter is a major factor in the distribution of molluscs within a habitat.

Only one record was from an area more than approximately 25 metres from the boundary wall, and that was from a rotting herbaceous stem near The Lake. The majority of records came from within approximately 10 metres of the boundary wall. The significance of the boundary wall appears to be that, not only is the area adjacent to it the least 'maintained', 'tidied' and 'managed', but the rear of most of the borders is supported by old wooden railway sleepers and planks of timber, thereby providing the necessary shelter and moist air for the molluscs. Twenty-two specimens, representing six species, were found sheltering under the sleepers and planks, or under flowerpots close to them.

The importance of an extensive system of moist interstices in the leaf litter, the vigour of the decomposer cycle and the concentration of calcium salts upon the distribution of terrestrial molluscs has been shown by Berry (1973). Some of the borders and flower beds in the Garden are frequently mulched with compost, making the leaf litter in those borders more congenial to molluscs. Thirty-one specimens, representing nine species, came from such areas. Five specimens representing four species were recorded from leaf litter which had collected in a sheltered area adjacent to the wall. In those borders and flower beds which are exposed to the drying effects of the wind, i.e. those near the lawn and without a layer of compost, only two specimens were found, one of *Oxychilus cellarius* and one of *Cepaea hortensis*.

The soil of the Garden is probably derived from flood-plain meadows overlying river gravel or sands. The soil pH of the borders and beds was in the range 5.0–6.8, measured in September 1998 (Bowlt pers. comm.). Whilst it is probable that it is the availability of calcium salts which influences the distribution of gastropods within a habitat, acid soils appear to be more favourable to slugs than to heavily shelled snails. It is worthy of note that of the eighteen terrestrial species recorded in the two surveys, nine are slugs, six have very thin shells (*Oxyloma pfeifferi, Vitrina pellucida, Aegopinella nitidula, Oxychilus draparnaudi, O. cellarius, O. alliarius*), one is extremely small (*Punctum pygmaeum*) and it is only *Cepaea hortensis* and *Helix aspersa* which have substantial shells. It is possible that both these species may obtain the necessary calcium by rasping the shells of their dead brethren, behaviour which I have observed in *H. aspersa* in sand dunes, and which has been reported for *C. nemoralis* by Pitchford (1955).

The data obtained in this study support the view that the main factors influencing the distribution of terrestrial molluscs within a large garden, are shelter and moisture. Further, in such a habitat it appears that low soil pH favours a molluscan assemblage composed of slugs and thin-shelled snails. However, details of the soil and leaf litter chemistry, together with data from a number of gardens are required in order to investigate this.

Freshwater species

Seventy-four species of molluscs are presently recognised as occurring naturally in fresh and brackish water in Britain (Kerney 1976*b*). Seven of these are confined to brackish water, leaving 39 species of gastropods and 28 species of bivalves to consider.

In Britain the natural life span of the majority of pulmonate gastropods is 9–15 months or less. The operculates are also presumed to be annuals, except for *Viviparus* species, which have been kept for up to five years in captivity (Boycott 1936).

Gastropods spend their active lives living in quite shallow water, from a few centimetres to half a metre or so, occupying a narrow zone around the edge of the water body, which is also where most of the emergent vegetation occurs. The sampling technique employed in this study was therefore considered adequate for present purposes.

No bivalves were recorded from The Lake during the present study despite searching through the mud on the bottom as far as the pole and nylon scoop would reach, and none had been recorded in the previous survey (Evans et al. 1964). Nor were any were encountered by Colin Plant, who netted The Lake extensively, including the central area, whilst searching for aquatic insects on 20 October 1995. The absence of bivalves suggests anaerobic bottom conditions (Kerney and Stubbs 1980) and examination of the mud extracted in the search was also indicative of such conditions, although it was not tested.

The Lake is frequented by ducks and Canada geese. Waterfowl can completely destroy all molluscs in a pond or ornamental water by the putrefactive fouling of the water as much as by actual eating (Boycott 1936). Gastropods were recorded only from the area close to the artificial waterfall, which would suggest that only in that area was the oxygen level high enough to support them.

The molluscs collected included *Bithynia tentaculata, Gyraulus albus, Hippeutis complanatus* and *Planorbarius corneus* which are all species commonly associated with rather inferior loci such as ornamental ponds and lakes in the south of England. *Potamopyrgus antipodarum* and *Armiger crista* had been recorded in the previous survey but could not be found during the present study. Both of these are also commonly found in ponds and lakes in southern England.

Ferrissia wautieri was found on stones and on the underside of *Nymphaea* leaves in the area close to the waterfall. This small freshwater limpet was first recorded in Britain in 1976 (Brown 1977) and has since been found most frequently in artificial ponds and lakes, but occasionally occurs in natural waters (Preece and Wilmot 1979; Falkner and von Proschwitz 1998).

List of Mollusca recorded from Buckingham Palace Garden

The species recorded are included in the list below, which follows Waldén (1976) for terrestrial species and Kerney (1976a) for the freshwater species. Those species which have been recorded both in the present study and in the previous survey (Bristowe 1964; Evans et al., 1964) are preceded with an asterisk. Species recorded in the previous survey, but not found in the present study, are shown enclosed in round brackets. None of the species recorded is a *Red Data Book* species, (Bratton 1991); nor is any considered to be under threat or in need of conservation action at present.

TERRESTRIAL SPECIES

GASTROPODA

EUTHYNEURA

Succineidae
Oxyloma pfeifferi (Rossmässler, 1835)

Endodontidae
Punctum (Punctum) pygmaeum (Draparnaud, 1801)

Arionidae
* *Arion (Kobeltia) hortensis* Férussac, 1819
Arion (Kobeltia) intermedius Normand, 1852

Vitrinidae
Vitrina (Vitrina) pellucida (Müller, 1774)

Zonitidae
Aegopinella nitidula (Draparnaud, 1805)
(*Oxychilus (Oxychilus) draparnaudi* (Beck, 1837))
* *Oxychilus (Oxychilus) cellarius* (Müller, 1774)
Oxychilus (Ortizius) alliarius (Miller, 1822)

Milacidae
Tandonia sowerbyi (Férussac, 1823)
(*Tandonia budapestensis* (Hazay, 1881))

Limacidae
Limax (Limax) maximus L., 1758
Limax (Limacus) flavus L., 1758
Lehmannia valentiana (Férussac, 1823)
* *Deroceras (Agriolimax) reticulatum* (Müller, 1774)

Testacellidae
Testacella (Testacella) scutulum Sowerby, 1821

Helicidae
Cepaea hortensis (Müller, 1774)
Helix (Cornu) aspersa Müller, 1774

FRESHWATER SPECIES

GASTROPODA

PROSOBRANCHIA

Hydrobiidae
(*Potamopyrgus antipodarum* (Gray, 1843))

Bithyniidae
* *Bithynia tentaculata* (L., 1758)

EUTHYNEURA

Planorbidae

* *Gyraulus albus* (Müller, 1774)
(*Armiger crista* (L., 1758))
Hippeutis complanatus (L., 1758)
Planorbarius corneus (L., 1758)

Ancylidae

Ferrissia wautieri (Mirolli, 1960)

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References

BERRY, F. G. 1973. Patterns of snail distribution at Ham Woods National Nature Reserve, East Kent. *J. Conch. Lond.* **28**: 23–36.

BISHOP, M. J. 1977. The Mollusca of acid woodlands in West Cork and Kerry. *Proc. R. Ir. Acad.* B, **13**: 227–244.

BOYCOTT, A. E. 1934. The habitats of land Mollusca in Britain. *J. Ecol.* **22**: 1–38.

BOYCOTT, A. E. 1936. The habitats of fresh-water Mollusca in Britain. *J. Anim. Ecol.* **5**: 116–186.

BRATTON, J. H. (ed.) 1991. *British Red Data Books:* **3**. *Invertebrates other than insects*. Joint Nature Conservation Committee, Peterborough.

BRISTOWE, W. S. 1964. Land invertebrates other than insects. In: McClintock, D.C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. Trans. S. Lond. Ent. & Nat. Hist. Soc.*, 1963: 48–54.

BROWN, D. S. 1977. *Ferrissia* — A genus of freshwater limpet new for Britain. *Conchologists' Newsl.* **4**: 23–25.

BUCKLE, P. U. 1998. Field meeting in South Somerset 17 – 19 April 1998. *Conchologists' Newsl.* **9**: 84–89.

CASTELL, C. P. 1962. Some notes on London's molluscs. *J. Conch. Lond.* **25**: 97–117.

EVANS, J. H., GILCRIST, BARBARA M. and GREEN, J. 1964. The lake. In natural history of the garden of Buckingham Palace. *Proc. Trans. S. Lond. ent. nat. Hist. Soc.*, 1963, pt. II: 99–109.

FALKNER, G. and VON PROSCHWITZ, T. 1998. A record of *Ferrissia (Pettancylus) clessiniana* (Jickeli) in Sweden, with remarks on the identity and distribution of the European *Ferrissia* species. *J. Conch. Lond.* **36**: 39–40.

KERNEY, M. P. 1976*a*. A list of the fresh and brackish-water Mollusca of the British Isles. *J. Conch., Lond.* **29**: 26–28.

KERNEY, M. P. 1976*b*. *Atlas of the non-marine Mollusca of the British Isles*. Institute of Terrestrial Ecology, Abbots Ripton, Huntingdon.

KERNEY, M. P. and CAMERON, R. A. D. 1979. *A field guide to the land snails of Britain and north-west Europe*. Collins, London.

KERNEY, M. P. and STUBBS, A. E. 1980. *The conservation of snails, slugs and freshwater mussels*. Nature Conservancy Council.

PITCHFORD, G. W. 1955. *Helix nemoralis* (L.) in a calcium deficient habitat. *J. Conch. Lond.* **24**: 54.

PREECE, R. C. and WILMOT, R. D. 1979. *Marstoniopsis scholtzi* (A. Schmidt) and *Ferrissia wautieri* (Mirolli) from Hilgay, Norfolk. *J. Conch. Lond.* **30**: 135–139.

QUICK, H. E. 1960. *Limax (Lehmannia) poirieri* Mabille near Reading. *J. Conch. Lond.* **24**: 398.

WALDEN, H. W. 1976. A nomenclatural list of the land Mollusca of the British Isles. *J. Conch. Lond.* **29**: 21–25.

WARDHAUGH, A. A. 1996. The terrestrial molluscan fauna of some woodlands in north-east Yorkshire, England. *J. Conch. Lond.* **35**: 313–327.

WÄREBORN, I. 1969. Land molluscs and their environments in an oligotrophic area in southern Sweden. *Oikos* **20**: 461–479.

WILLING, M. J. 1986. Report of the field meeting held on 28th. September 1985 — 'Hunting the Cheese Snail' *Conchologists' Newsl.* **5**: 360–25.

Spiders and other Arachnida in Buckingham Palace Garden

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Abstract

A survey of the Buckingham Palace Garden for arachnids other than mites was carried out. A total of 112 species of spider, one pseudoscorpion and six harvestmen was collected. The species list was compared with that from an earlier survey, showing that around two thirds of the earlier species were rediscovered, but a substantial number (seventy-one spiders, one pseudoscorpion and five harvestmen) of new records were made. Some observations are made about the rather anomalous spider fauna and some possible explanations for the nature of the existing assemblage and the apparent changes since the 1964 survey are given.

Introduction

Records of spiders from Buckingham Palace Garden go back to W. S. Bristowe's first visit there in May 1929 when he collected twenty-nine species; by 1964, fifty-seven species had been recorded (Bristowe 1964). The present total stands at 131 species, although some of these are probably no longer present today and the list includes records of others that may never have been established and may have been brought into the Garden on plants or with soil. Bristowe himself suggested that some of the spiders that he listed in 1964 came into this category.

A single species of pseudoscorpion (Pseudoscorpiones) and a single harvestman (Opiliones), were also recorded from the Garden by Bristowe; brief reports on these two groups follow the account of the spiders.

In this report the nomenclature used for spiders follows Merrett *et al* (1985) with amendments by Merrett & Millidge (1992) and Nellist (1998). Where different names were used by Bristowe, these have been included in brackets. The nomenclature for pseudoscorpions follows Legg and Jones (1988) and that used for harvestmen follows Hillyard and Sankey (1989).

Personnel, materials and methods

In the course of this study, a number of visits were made to the Garden by the author and by David Nellist for the purpose of searching for, or pitfall-trapping, spiders. Colin Plant set some pitfall traps for a short time, collected some spiders while searching for insects and found some spiders in the Malaise trap: of these some were identified by Peter Harvey, others by the author. Finally the Head Gardener, Mark Lane, sent the author a number of specimens.

Various methods were used to collect spiders in the Garden, including grubbing about, sorting dead leaves and matted vegetation, beating and sweeping grass and other ground herbage, bushes and the lower branches of trees and shrubs. The author set some standard trios of pitfalls (Milner 1987) with a small quantity of ethylene glycol in the form of commercial anti-freeze and a wetting agent (commercial detergent) in each. The traps were set at four sites:

Site A — in low vegetation on the marshy edge of The Lake;
Site B — in a small area of short grass, partly shaded, inside the flamingo enclosure;
Site C — in partly shaded grass with anthills on top of The Mound;
Site D — in long grass on the north facing slope of The Mound.

The positions of these pitfall traps, and of those set elsewhere in the Garden by Colin Plant, are indicated in the map on pages 2 and 3.

All the sites were at least partly shaded, and were subject to mechanical mowing at least once per season, some more often. On more than one occasion some of the traps were damaged by the mowing machine, even at site D on quite a steep slope.

The pitfall traps were operated from July 1995 to the end of May 1997, being emptied and the catch sorted on a monthly basis.

Results

Spiders

As a result of this work, 112 spider species were recorded in the Garden during the period 1995-98. Of these, forty-one were species already recorded by Bristowe (including *Clubiona terrestris* which he omitted from the 1964 report) and seventy-one were species recorded in the Garden for the first time. A further seventeen species recorded by Bristowe in the Garden and buildings (including the cellars) were not found again. The total species list for the Garden therefore comprises 129 species of spider. Most of the spiders recorded are common species, but in addition there were three Nationally Notable species (Merrett 1990): *Zilla diodia*, *Porrhomma errans*, both recorded here for the first time in London and *Nigma walckenaeri*.

Results of pitfall-trapping

From the results of the standardised pitfall-trapping, an arbitrary twelve-month period, from 10 January 1996 to 10 January 1997, was selected so that comparisons with other 12-month catches could be made (Milner, in press). The overall results are given in Table 1 and details of the most frequently trapped species are given in Table 2.

The results from the four sites varied considerably, both in numbers and in species richness, with site C producing the highest total of both individuals and species, while site B, with the lowest scores for both, is clearly a relatively impoverished site. This may be partly due to the fact that the grassy area, although well-established, is very small, at about 4 x 1.5 metres. Site C, on the other hand, is clearly a much richer site, and the presence of an anthill at the beginning of the trapping period (it was later destroyed by the mowing), suggests a lower level of disturbance at least in the period preceding the trapping.

Comparing the data in Table 1 with data from 12-month samples at 82 pitfall-trapping sites around London (Milner, in press), Site A, which is categorised as wetland, produced 204 spiders of 25 species, compared with a mean for London of 301 spiders of 25.2 species.

TABLE 1: Pitfall-trapping at four sites in Buckingham Palace Garden: detail of sites and overall results from the period 10 January 1996 to 10 January 1997.

Site	Habitat	Estimated disturbance level	Total number of spiders	Number of species	Number of pioneer spiders (W)	Number of grassland spiders (G)	W/G
A	Low vegetation on marshy border of The Lake	high (mown twice)	204	25	83	16	5.2
B	Short grass in flamingo enclosure (part shaded)	medium (mown once)	168	19	16	46	0.35
C	Short grass with anthills on top of The Mound (part shaded)	medium (adjacent to mown grass)	364	35	22	21	1.05
D	Long grass on north-facing slope of the Mound	high (mown twice)	220	28	28	0	-

The mean score for short-grass sites is 892 spiders of 26.2 species. Sites B and C, which both come into this category, score very differently with only 168 spiders of 19 species for site B in the flamingo enclosure, and 364 spiders of 35 species for site C on top of The Mound. This is a particularly high score for species richness, well above the mean of 30.7 species per 12-month sample for all London grassland sites. Site D, in long grass on the slope of The Mound, scored 220 spiders of 28 species, which compares with the mean of 681 spiders of 30.8 species for long-grass sites in London.

One method of comparing grassland sites and their likely conservation value used by the writer (Milner 1993), is to count the numbers of seven pioneer or 'weed' spiders (*Oedothorax fuscus, Oedothorax retusus, Milleriana inerrans, Erigone dentipalpis, Erigone atra, Bathyphantes gracilis* and *Lepthyphantes tenuis*) present in a 12-month catch (value W). This can then be related to value G: the numbers of grassland specialists (defined as the lycosids) present. Sites where W/G is less than 1 are taken as reasonably healthy while those where W/G is greater than 1 are understood to be disturbed (and relatively unhealthy).

The values for W/G at these sites are given in the last column of Table 1, but the results are inconclusive. The number of pioneer species (W score) is lower than expected for all the sites, but the number of grassland spiders is also low. However, the predominance of pioneers at site A suggests that, although damp and marshy, this location has a spider assemblage that is untypical, presumably due to the high level of disturbance affecting it more than the grassland sites.

More telling, perhaps, is the species composition of the catch at each site. Table 2 lists all the species trapped at three or more sites and gives the total for each species in the sample 12-month trapping period. Six species were trapped at all four sites in the sample period: *Enoplognatha thoracica, Pachygnatha degeeri, Micrargus subaequalis, Panamomops sulcifrons, Centromerita bicolor* and *Lepthyphantes tenuis*. Of these, perhaps the most surprising was *P. sulcifrons*, the tiny 'horned' spider, known for the unique feature of two, pointed protuberances on either side of its head. This species is often overlooked, as it appears to live deep in the vegetation, but in recent years it has been taken in pitfall traps in most parts of London. A number of other species occurred at all four sites, but not within the sample 12 month period. These were *Oedothorax fuscus, Diplocephalus latifrons, Erigone dentipalpis, Diplostyla concolor* and *Linyphia clathrata*.

At site A, the species list was most atypical of similar wetland and wetland fringe sites in London. Nine similar sites in London parks and public open spaces have been trapped for 12 month periods (Milner, in press), and a list of the ten most frequent species made. Only four of these ten are present at Buckingham Palace Garden, and even *Pachygnatha clercki*, present at all other such sites, is absent. However, unlike the other wetland/wetland fringe sites sampled, site A is unusual in being subjected to regular mowing and this probably has a negative effect on the spider fauna.

At the grassland sites, common species were also missing from the pitfall samples: site B lacked five of the ten commonest species found in other shaded grass sites in London, while site C lacked four of the ten. At site D, in long grass, only 5 of the 10 commonest species found in this habitat elsewhere in London were trapped, and most of the missing species were large ones (*Alopecosa pulverulenta, Pardosa amentata, Pachygnatha clercki*) all species likely to be affected most by regular mowing. Some, though not all, of these 'missing' species did occur in the Garden somewhere, but were found in such small number or in such limited areas, that trapping at sites A, B, C and D did not reveal them.

When the species lists are compared with those from the fourteen most disturbed grass sites elsewhere in London, seven of the ten most commonly found species (pioneer species and disturbed ground specialists) were also found at site A, eight at site D, nine at site B and all ten were taken at site C. This suggests that disturbance is one of the most important factors influencing the occurrence of spiders at these sites in the Garden.

TABLE 2. Pitfall-trapping at four sites in Buckingham Palace Garden: a list of all species trapped at 3 or more sites.

Numbers given are the totals trapped in 12-month period 10 January 1996 to 10 January 1997. An asterisk (*) indicates specimens trapped at the site outside the 12-month period.

Species	**Site A**	**Site B**	**Site C**	**Site D**
Clubiona terrestris	1	—	5	4
Pardosa pullata	8	40	9	—
Alopecosa pulverulenta	8	*	12	—
Enoplognatha thoracica	2	1	9	3
Pachygnatha degeeri	47	15	148	44
Oedothorax fuscus	*	*	*	1
Monocephalus fuscipes	*	—	1	7
Micrargus herbigradus	*	1	—	4
Micrargus subaequalis	2	8	2	11
Diplocephalus latifrons	*	4	*	29
Panamomops sulcifrons	1	7	2	1
Milleriana inerrans	—	*	*	*
Erigone dentipalpis	13	2	4	*
Erigone atra	—	*	2	1
Meioneta saxatilis	—	2	1	10
Centromerita bicolor	28	39	91	42
Microneta viaria	1	*	1	—
Bathyphantes gracilis	5	5	—	*
Tapinopa longidens	2	—	1	1
Stemonyphantes lineatus	1	—	4	1
Diplostyla concolor	2	24	4	*
Lepthyphantes tenuis	65	9	16	26
Lepthyphantes flavipes	4	—	4	3
Lepthyphantes ericaeus	1	*	—	5
Lepthyphantes pallidus	1	—	2	1
Linyphia clathrata	2	2	*	2

Discussion

In Bristowe's report for the 1964 survey he remarked that 'The spider fauna of the Garden is specially interesting for its absentees. Any garden of this area and nature outside the built-up area of a city would be expected to have a number of other species, and a greater abundance of others which are scarce.........'. Among the absentees that Bristowe expected to find were *Dysdera (crocata)*, *Drassodes (lapidosus)*, several species of Lycosidae, *Theridion sisyphium*, *Tetragnatha* spp., *Metellina (Meta) segmentata* and at least two species of *Linyphia*. Interestingly, most of these species have subsequently been found, and some of them, in particular some lycosids, are today fairly common throughout the Garden (except on the lawns) — though they were clearly absent 35 years ago. He went on to suggest that perhaps the missing species 'were unable to survive the soot deposits and acidity of the soil'. This may have been the situation only a short time after the first Clean Air Act of 1956, but neither of these environmental hazards are a major problem in the Garden today.

Bristowe's list of spiders, if it was the list for a site today, would suggest a highly disturbed and impoverished habitat. *Oedothorax retusus, Erigone dentipalpis, E. atra, Meioneta rurestris* and *Diplostyla (Bathyphantes) concolor* were all 'common' according to his observations, while apparently there were few other linyphiids and hardly any lycosids. Among the species which he found to be 'scarce' were some which are among London's commonest and most abundant species (such as *Bathyphantes gracilis* and *Lepthyphantes tenuis*). Others such as *Diplocephalus cristatus* are still present, but are rather scarce today in London. Some species such as *Centromerita bicolor* and *Macrargus rufus* were probably missed because they are winter-active species that are rarely seen in the summer.

No pitfall-trapping was done in the Garden in the 1960s, so some of the smaller species could well have been missed, but some of the larger linyphiids such as *Walckenaeria acuminata* and *Stemonyphantes lineatus* are not at all difficult to find by hand searching. Were they present, but missed by Bristowe because they were so scarce? Or were they absent at that time and have recolonised the Garden since the 1960s?

There may have been quite substantial changes in the spider fauna of London in the past few decades, and in addition the management of the Garden has probably changed a great deal. For example, Bristowe's list suggests that there was little or no long grass extant in the 1960s. Presumably the mowing regime was strict and general 'tidiness' of the Garden more rigorously interpreted than is customary today — except possibly around the edge of The Lake. Evidence for these observations includes the absence from Bristowe's list of normal grassland lycosids such as *Pardosa pullata, P. palustris and Alopecosa pulverulenta* (today three of the commonest spiders in London), which are all found in reasonable numbers in the Garden today. Even *P. prativaga,* which was 'not established' in the 1960s, is now clearly part of the spider fauna in the Garden, though it is scarce.

The presence of two marshland *species (Pirata piraticus* and *Gnathonarium dentatum*) in Bristowe's list, neither of which appear to be present today, suggests that there was some lakeside vegetation which remained unmown through the season; this is not the case today. The pitfall-trapping within a foot of the edge of The Lake by the author was particularly disappointing, as it resulted in catches which were almost completely devoid of species with any affinity to normal marshland or pond-sides.

Implications for conservation

In terms of managing the Garden for the conservation of spiders and other arachnids, and to encourage and enhance these faunas, any means of allowing some areas of open grassland to remain permanently uncut would be most helpful. Many species present in the Garden seem to be surviving at very low population levels and any relaxation of the mowing and other disturbance would benefit many species. It should allow spider assemblages which are nearer to those occurring in less disturbed grassland in London to develop, with the numbers of pioneers dropping and being replaced by greater numbers of typical grassland species. Some of the larger species, such as *Tetragnatha* spp. and *Araneus* spp., depend on tall herbs and grass remaining undamaged through the winter for their eggs or hibernating adults to survive. Without this they are always going to be very vulnerable in the Garden. Exactly how disturbance affects smaller species is not known, but even among the small ground-living spiders it is clear that reduced levels of disturbance benefit many species, while high levels of disturbance favour only a few pioneers.

Ideally, the banks of The Lake should also remain unmown and uncut. This would give an opportunity for a normal lakeside or pond-side vegetation to develop. This would not need to be a wide band of such vegetation, a metre or so would be quite adequate, but it could over time result in the build-up of a normal marshland spider community, some of whose members were present in the 1960s. How long this would take is not known, but might be as little as a few years.

Pseudoscorpions

One new pseudoscorpion, *Roncus lubricus*, was found in mossy grass on The Mound, but the single species previously recorded by Bristowe, *Neobisium muscorum*, was not found again.

Harvestmen

Six species of harvestman were recorded, of which only one, *Phalangium opilio*, had been previously recorded.

An annotated list of Arachnida (excluding Acari), recorded in Buckingham Palace Garden

All records are by the author unless stated. Where the name used by Bristowe (1964) has since been superseded the earlier name is given in brackets. Species found in the earlier survey, but not found during the present study, are shown enclosed in round brackets. Taxa recorded in both surveys are indicated by an asterisk. Nationally Notable category A (Na) and category B (Nb) species are those listed by Merrett (1990).

ARANEA

Amaurobiidae

* *Amaurobius fenestralis* (Stroem, 1768)

This species was apparently common in London at one time: it appears to be relatively scarce today. Bristowe reported it as common under bark in the Garden, but today it appears to have largely been replaced by *A. similis*, and even to some extent by *A. ferox*. In the course of the present study a single individual was found, whereas both the other *Amaurobius* species appeared regularly in pitfall traps at several sites.

* *Amaurobius similis* (Blackwall 1861)

Common according to Bristowe, and frequent on walls and under bark today.

Amaurobius ferox (Walckenaer, 1830)

Not recorded by Bristowe, but during this survey found commonly under logs and in similar places.

Dictynidae

Dictyna uncinata Thorell, 1856

Common in long grass and herbs, especially early in the season.

* *Nigma walckenaeri* (Roewer, 1951) (*Dictyna viridissima*)

Swept and beaten from bushes and tall herbs, but uncommon today as in the 1960s. A nationally Notable (category Na) species.

Oonopidae

* *Oonops pulcher* Templeton, 1835

Common under bark today as in the 1960s

(*Oonops domesticus* de Dalmas, 1916)

'One specimen in the Gardener's office' (Bristowe); not seen in the Garden since.

Dysderidae

(*Dysdera erythrina* (Walckenaer, 1802))

A single specimen amongst flowerpots in a greenhouse 'apparently recently imported, and not established here' (Bristowe). Not seen since.

Dysdera crocata C. L. Koch, 1838

Both sexes trapped in mossy grass on top of The Mound, and also collected from among dead leaves. Its presence was predicted by Bristowe.

* *Harpactea hombergi* (Scopoli, 1763)

Common under bark, since the 1960s.

Segestriidae

Segestria senoculata (Linnaeus, 1758)

A single specimen found in its web during this survey in May 1998 on a large plane tree near the Tennis Court.

* *Segestria florentina* (Rossi, 1790)

'On the outside of the walls from 1946 to 1949 only' (Bristowe). This species appears to have been expanding its range in London (Milner 1995), and was rediscovered on the inside of walls around the Garden by Mark Lane in 1997.

Pholcidae

(*Pholcus phalangioides* (Fuesslin, 1775))

Both this species and the next were found by Bristowe in the cellars. So far no contemporary search of the cellars has been made, and neither species has been seen in the outbuildings.

(*Psilochorus (Physocyclus) simoni* (Berland, 1911))

Found by Bristow in cellars.

Gnaphosidae

* *Drassodes lapidosus* (Walckenaer, 1802)

The original record was a single immature specimen probably imported with soil: during this survey a single specimen was found in the Malaise trap in 1996.

(*Scotophaeus (Herpyllus) blackwalli* (Thorell, 1871))

Bristowe found this species in the Gardener's offices. It has not been seen in recent times, but may occur around the older buildings or under bark.

* *Micaria pulicaria* (Sundevall, 1832)

This species is associated with ants and is fairly widespread in London. Bristowe found 'several running on a southern (facing) bank'. A single male was trapped during this survey near The Lake in May 1997.

Clubionidae

* *Clubiona corticalis* (Walckenaer, 1802)

Common under bark of the larger trees since the 1960s.

(*Clubiona reclusa* O.P.-Cambridge, 1863)

'On shrubs' according to Bristowe: not seen recently, although it is fairly common in London.

Clubiona pallidula (Clerck, 1757)

Not recorded in London until May 1996 when two males were swept from vegetation, one was found in the Malaise trap and a substantial colony was seen under the eaves of a wooden shed inside the flamingo enclosure. Unfortunately, this building was subsequently demolished and the timber taken away. It is hoped that this species has survived elsewhere in the Garden as this is still the only known site for the species in the county. It has been recorded since: David Nellist found a single male under the cover of the Sand-Pit in May 1998.

Clubiona phragmitis C. L. Koch, 1843

Not recorded by Bristowe, but during this survey a few specimens were taken among vegetation near The Lake in 1995 and 1997.

Clubiona terrestris Westring, 1851

This common species is recorded by Savory & Le Gros (1957) as occurring at Buckingham Palace, but does not appear in Bristowe's list from 1964. During this survey, several specimens were trapped at sites A, C and D; it is fairly common among vegetation in the shaded parts of the Garden.

Clubiona compta C. L. Koch, 1839

Not recorded by Bristowe; during this survey it was found infrequently on The Mound and elsewhere among denser vegetation. This species, like *C. brevipes*, is known to spend much of the summer in the upper parts of trees and bushes.

* *Clubiona brevipes* Blackwall, 1841

Beaten from trees and occasionally under bark; recorded by Bristowe and found infrequently during this survey.

Liocranidae

Phrurolithus festivus (C. L. Koch, 1835)

Not recorded by Bristowe. This species is an ant mimic and is usually found near ants' nests. A single female was found by David Nellist underneath sheets of chipboard near the recycling centre in May 1998, and he later (June) found both sexes among vegetation at a number of points around the edge of The Lake. No specimens were taken in pitfall traps.

Thomisidae

* *Xysticus cristatus* (Clerck, 1757)

Common in all but the shortest grass in most parts of the Garden since the 1960s.

Xysticus kochi Thorell, 1872

Not seen by Bristowe. In this survey a few specimens were taken by sweeping and in pitfall traps on the top of The Mound.

Ozyptila (Oxyptila) praticola (C. L. Koch, 1937)

Not recorded by Bristowe. During this survey two specimens were found on the slopes of The Mound in long grass in August 1995.

Philodromidae

Philodromus aureolus (Clerck, 1757)

Not recorded by Bristowe; during this survey it was swept from lower branches and bushes in some abundance.

Philodromus cespitum (Walckenaer, 1802)

Not recorded by Bristowe; during this survey a single male was swept from long grass near the Tennis Court in May 1998.

Philodromus dispar Walckenaer, 1825

Not recorded by Bristowe. A common species in London today, but apparently very scarce in the Garden. During this survey only two females were found, in the Malaise trap.

* *Tibellus oblongus* (Walckenaer, 1802)

'Common in one area near The Lake' (Bristowe), but during this survey only a single immature female was found in the Malaise trap. A species that prefers long grass or reeds, it may have been a casualty of increased mowing and disturbance around The Lake.

Salticidae

* *Salticus scenicus* (Clerck, 1757)

Found on walls, especially south-facing, in the 1960s and today.

* *Euophrys frontalis* (Walckenaer, 1802)

'Common on sunny banks' according to Bristowe, and found quite commonly among grass during this survey, especially on The Mound.

Euophrys lanigera (Simon, 1871)

Not found by Bristowe, but during this survey it was found on some of the older walls, especially where these were south-facing.

Sitticus pubescens (Fabricius, 1755)

Not seen by Bristowe, and uncommon today in London. During this survey both sexes were taken on a south-facing wall near the greenhouses in The Yard.

Lycosidae

Pardosa palustris (Linnaeus, 1758)

Common today at several places in uncut grassy areas (and elsewhere in London), although apparently absent in the 1960s.

Pardosa pullata (Clerck, 1757)

Not found by Bristowe, but during this survey it was found to be abundant in many parts of the Garden, as it is in long grass in most open spaces in London.

* *Pardosa prativaga* (L.Koch, 1870)

Bristowe reported this species from a single specimen collected by Mr Bradley, and observed that it was 'definitely not established in the Garden'. Several specimens were taken during the current survey, including three trapped on the patch of grass in the flamingo enclosure where it is probably established today.

Alopecosa pulverulenta (Clerck, 1757)

Not seen by Bristowe, this large lycosid is now common in those parts of the Garden where the grass is allowed to grow long for at least part of the summer.

(*Trochosa terricola* Thorell, 1856)

'Scarce' in 1963 and surprisingly not found during this survey, although it is one of the commonest grassland spiders in the London area.

(*Pirata piraticus* (Clerck, 1757))

'The only common lycosid' according to Bristowe, who found it around the fringes of The Lake. Surprisingly, this common marshland species appears to be absent today, almost certainly a casualty of mowing and disturbance around The Lake. However, it could be reintroduced at any time with almost any water weed or marshland plant.

Pisauridae

Pisaura mirabilis (Clerck, 1757)

Not seen by Bristowe; during this survey a few specimens were trapped in long grass on The Mound. Like other larger grassland species it may need patches of grass left uncut through the winter before it will thrive in the Garden. This also applies to the Tetragnathidae and Araneidae.

Agelenidae

Tegenaria gigantea Chamberlin & Ivie 1935

Not found by Bristowe, but during this survey found among plantpots, and under Gardeners' debris in several places. Rather surprisingly, it was also trapped at sites in the flamingo enclosure and on The Mound.

(*Tegenaria atrica* C. L. Koch, 1843)

In 'outhouses' according to Bristowe; but not seen since - indeed not recorded in London at all for many years.

* *Tegenaria domestica* (Clerck, 1757)

Common in and around buildings since it was recorded by Bristowe originally in 1938; several specimens were found during the present survey.

Mimetidae

Ero furcata (Villiers, 1789)

Not seen by Bristowe but, during this survey a few specimens were trapped in the flamingo enclosure and on top of The Mound.

Theridiidae

* *Steatoda bipunctata* (Linnaeus, 1758)

Common around buildings today as during the 1960s.

Anelosimus vittatus C. L. Koch (1836)

Not found by Bristowe, but during this survey it was frequently swept from vegetation.

Achaearanea lunata (Clerck, 1757)
Not seen by Bristowe, but during this survey David Nellist found several females on webs at the base of large trees and along the wall adjacent to Constitution Hill.

(*Achaearanea tepidariorum* (C. L. Koch, 1841))
A hothouse species, first found in 1929 and restricted to a single individual in 1962, according to Bristowe. Not seen since.

* *Theridion varians* Hahn, 1833
Common on bushes and the lower branches of trees according to Bristowe; apparently less common today, but still swept from trees and bushes occasionally.

* *Theridion melanurum (denticulatum)* Hahn, 1831
Fairly common on the lower branches of trees since the 1960s.

Theridion mystaceum L. Koch 1870
Not recorded by Bristowe; during this survey several individuals were beaten from holly bushes adjacent to Constitution Hill by David Nellist.

Theridion tinctum (Walckenaer, 1802)
Not recorded by Bristowe; during this survey several females were beaten from the lower branches of trees and bushes near the Tennis Court and the Recycling Centre.

Theridion instabile O.P.-Cambridge, 1870
Not recorded by Bristowe; during this survey several specimens were swept from long grass and low bushes near the Tennis Court.

* *Theridion bimaculatum* (Linnaeus, 1767)
Only a single specimen was found by Bristowe, but it is fairly common throughout the Garden today.

Theridion pallens Blackwall, 1834
Not recorded by Bristowe, but common today on foliage especially on trees and bushes.

* *Enoplognatha ovata* (Clerck, 1757)
Frequent in long grass, now as in the 1960s.

* *Enoplognatha thoracica* (Hahn, 1833)
Common now as in the 1960s; one of only six species trapped at all four pitfall sites.

Pholcomma gibbum (Westring, 1851)
A small woodland spider which occurs even at disturbed sites (it is known from Hyde Park). It was not recorded by Bristowe, but during this survey David Nellist found two females when beating the lower branches of conifers and holly bushes near The Mound.

Nesticidae

(*Nesticus cellulanus* (Clerck, 1757))
Found by Bristowe in a damp outhouse, but not seen since.

Tetragnathidae

Tetragnatha extensa (Linnaeus, 1758)
No *Tetragnatha* species were recorded by Bristowe, but three were found during this survey. A single adult female *T. extensa* was swept from dense herbage near the north-west corner of the Garden during May 1997.

Tetragnatha montana Simon, 1874
Both sexes were swept from tall herbaceous vegetation on the north-eastern slope of The Mound during June 1997, by David Nellist.

Tetragnatha obtusa C. L. Koch, 1837
Both sexes swept from vegetation in May 1997 and June 1998, the former being one of the first records of this species for London (Milner 1998).

* *Pachygnatha clercki* Sundevall, 1823
'Amongst vegetation near The Lake' according to Bristowe; during this survey a few specimens were found in long grass near The Mound in August 1995, but otherwise this very common London species was conspicuous by its scarcity.

* *Pachygnatha degeeri* Sundevall, 1830
Very common, especially in longer grass, today as in the 1960s.

(*Metellina (Meta) segmentata*(Clerck, 1757))
'On herbs near The Lake but noticeably absent from shrubs and evergreens' according to Bristowe; during this survey none were found, although it is common elsewhere in London.

* *Zygiella x-notata* (Clerck, 1757)
Common on buildings and fences today as in the 1960s.

Araneidae

Gibbaranea gibbosa (Walckenaer, 1802)
Not recorded by Bristowe, but during this survey a few specimens were swept from dense foliage in different places.

* *Araneus diadematus* Clerck, 1757
Common in the Garden according to Bristowe, but not so frequently found today. During this survey only one pair of adults was found, on bushes near the Tennis Court by Colin Plant, in September 1995. Elsewhere in London it is common, even in the central area.

(*Larinioides sclopetarius*(Clerck, 1757))
'Common on bridges over The Lake' according to Bristowe, but not seen since.

Nuctenea umbratica (Clerck, 1757)
Not recorded by Bristowe, but during this survey a single mature female was found on a web on the Indian Bean Tree near The Lake in map square H9.

* *Araniella (Araneus) cucurbitina* (Clerck, 1757)
'Several on deciduous shrubs' according to Bristowe; during this survey in 1998 several individuals were swept from trees and bushes near the Tennis Court by David Nellist.

Araniella (Araneus) opisthographa (Kulczynski, 1905)
Not recorded by Bristowe: during this survey a single female was swept from bushes near the Tennis Court in May 1997.

Zilla diodia (Walckenaer, 1802)
In May 1996 a single male of this Nationally Notable (Nb) species was found near The Yard. This species does not otherwise occur in London and the nearest site is probably Burnham Beeches, Buckinghamshire — a large expanse of ancient wood pasture and woodland. Unless further specimens are found, this example must be regarded as an isolated introduction, probably imported into the Garden on bushy plants.

Linyphiidae

Although the Linyphiidae (money spiders) is the major family of British spiders with over 40 per cent of all species, it was poorly represented in Bristowe's 1964 list. He recorded just 17 species — mainly ubiquitous species or pioneers. Many of these species are very small and some are difficult to find. During this survey, various searches and in particular the pitfall-trapping, has augmented this list considerably, but it is likely that several of the new additions were present earlier and had been overlooked.

Walckenaeria acuminata Blackwall, 1833
Not recorded by Bristowe; during this survey this species was found to be fairly common and was trapped on The Mound.

Walckenaeria antica (Wider, 1834)
Not recorded by Bristowe: during this survey found to be slightly commoner than *W. acuminata* in grass on The Mound.

Walckenaeria atrotibialis (O.P.-Cambridge, 1876)
Not recorded by Bristowe: during this survey two females were trapped at site D on the slope of The Mound in August.

?**Dicymbium brevisetosum* Locket, 1962 (originally reported as *Dicymbium nigrum* (Blackwall, 1833)
These two species were separated in 1962, but the females are indistinguishable. Bristowe recorded a single female, but as no males of *D. nigrum sensu stricto* have yet been found

anywhere in London county, it is probable that his specimen was *D. brevisetosum*. During the present survey, one male *D. brevisetosum* and two females (assumed to be the same species) were trapped at sites C and D on The Mound.

(*Entelecara erythropus* (Westring, 1851))
'Several amongst vegetation' according to Bristowe; and reported by Savory and Le Gros earlier (1957), but not seen during the present survey.

(*Gnathonarium dentatum* (Wider, 1834))
A fairly common marshland and pond-fringe species throughout London. Bristowe reported several amongst vegetation around The Lake. The fact that this species is now apparently absent is almost certainly due to the regular mowing of the lakeside vegetation.

Maso sundevalli (Westring, 1851)
A woodland litter species, not recorded by Bristowe. During this survey two males were trapped on The Mound in June 1996.

Pocadicnemis juncea Locket & Millidge, 1953
A common grassland species in London, but not recorded by Bristowe. During this survey two female were trapped on top of The Mound.

* *Oedothorax fuscus* (Blackwall, 1834)
A common pioneer species. 'A few specimens' were found by Bristowe, and similarly one or two specimens were found in the present survey at each of the trap sites.

* *Oedothorax retusus* (Westring, 1851)
'Common amongst vegetation' according to Bristowe; during this survey a few specimens were trapped in the flamingo enclosure and on The Mound.

Trichopterna thorelli (Westring, 1861)
Not recorded by Bristowe. During this survey a single male was found in The Yard among dead leaves in June 1997. This is the only record of the species in London and must be thought of as an isolated importation to the Garden.

Tiso vagans (Blackwall, 1834)
Not recorded by Bristowe; during this survey a few specimens were trapped on The Mound, and one near The Lake.

Monocephalus fuscipes (Blackwall, 1836)
A woodland species often found in disturbed habitats. Not recorded by Bristowe; during this survey it was found quite commonly among grass on The Mound and two specimens were trapped near The Lake.

Gongylidiellum vivum (O.P.-Cambridge, 1875)
A common spider in short grass around London. Not recorded by Bristowe; during this survey a single specimen was trapped in the flamingo enclosure.

Micrargus herbigradus (Blackwall, 1854)
A common spider of grassland and woodland in London. Not recorded by Bristowe; during this survey a few individuals were trapped on The Mound and in the flamingo enclosure.

Micrargus subaequalis (Westring, 1851)
Not recorded by Bristowe, and not a common spider in London, but during this survey it was trapped at all four pitfall sites and was common among grass in several parts of the Garden.

Erigonella hiemalis (Blackwall, 1841)
Not recorded by Bristowe, but during this survey it was found quite commonly on The Mound.

(*Savignia frontata* (Blackwall, 1873))
A pioneer species and frequent aeronaut, quite common in London although its appearance is quite unpredictable. A single specimen was collected by Bristowe, but it has not been seen in the Garden since.

* *Diplocephalus cristatus* (Blackwall, 1833)
'Common amongst vegetation' according to Bristowe, but not at all common anywhere in London today. During this survey, Colin Plant found two specimens in grass, on the north side of the Garden.

Diplocephalus latifrons (O.P.-Cambridge, 1868)
A species of disturbed woodland common throughout London. It was not recorded by Bristowe, but during this survey it was found to be common throughout the Garden.

Diplocephalus picinus (Blackwall, 1841)
One of the commonest species in London, but not recorded by Bristowe, and during this survey only three specimens were found in grass near The Lake.

Panamomops sulcifrons (Wider, 1834)
This tiny species, the 'horned spider', is fairly common throughout London. It was not recorded by Bristowe, but during this survey several specimens were trapped at sites on The Mound, in the flamingo enclosure and near The Lake.

Milleriana inerrans (O.P.-Cambridge, 1886)
A pioneer species common in agricultural land and widely distributed in London. Not recorded by Bristowe, but found among grass in several parts of the Garden during this survey.

* *Erigone dentipalpis* (Wider, 1834)
Very common in the Garden since the 1960s, as it is throughout London.

* *Erigone atra* Blackwall, 1833
Common in the Garden since the 1960s, as it is throughout London.

Porrhomma errans (Blackwall, 1841)
A rare (Notable — Nb) linyphiid, not previously recorded in London. A single female was trapped on the south-eastern slope of The Mound in November 1995.

* *Meioneta rurestris* (C. L. Koch, 1836)
A very common species among grass throughout London and found frequently in the Garden both in the 1960s and today.

Meioneta saxatilis (Blackwall, 1844)
During this survey it was found to be very common throughout the Garden, but strangely it is absent from Bristowe's list.

(*Meioneta beata* (O.P.-Cambridge, 1906))
Recorded by Bristowe, but not seen since.

Microneta viaria (Blackwall, 1841)
Very common in the Garden today, but strangely not found by Bristowe.

Centromerus sylvaticus (Blackwall, 1841)
A winter-active, woodland species, common throughout London. Not recorded by Bristowe; during this survey a single male was trapped on top of The Mound in January 1997.

Centromerus dilutus (O.P.-Cambridge, 1876)
A tiny woodland species, not very commonly found in London. Not recorded by Bristowe, but during this survey a single male was trapped inside the flamingo enclosure in May 1997.

Centromerita bicolor (Blackwall, 1833)
A winter-active species not recorded by Bristowe, but found very commonly throughout the grassy areas of the Garden mainly from November to March.

Macrargus rufus (Wider, 1834)
A very common London species, yet not recorded by Bristowe. During this survey three individuals were trapped on the top of The Mound, mostly during the winter months.

Bathyphantes gracilis (Blackwall, 1841)
This species is a real mystery. It is the second most common ground-living species in London (Milner, in press), a disturbed ground specialist and pioneer, yet it was not recorded by Bristowe. During this survey it was found in small numbers in most parts of the Garden, but only trapped at the two low-lying sites — near The Lake and inside the flamingo enclosure.

Tapinopa longidens (Wider, 1834)
Not recorded by Bristowe, but during this survey it was found to be fairly common in late summer and autumn; trapped at both sites on The Mound and by The Lake.

Stemonyphantes lineatus (Linnaeus, 1758)
Not recorded by Bristowe; during this survey it was found occasionally among longer grass in several parts of the Garden.

* *Lepthyphantes leprosus* (Ohlert, 1865)
Recorded by Bristowe (a single specimen); during this survey a few individuals were found by David Nellist among dead leaves at the base of trees along the wall facing Constitution Hill, and among plant pots in The Yard.

Lepthyphantes minutus (Blackwall, 1833)
Not recorded by Bristowe; during this survey a few specimens were taken around the base of trees in the wooded areas on The Mound.

Lepthyphantes obscurus (Blackwall, 1841)
A rare spider in London, only known from one other site (Hampstead Heath). Not recorded by Bristowe, but during this survey a single female was beaten from heather overhanging the main path in July 1998 by David Nellist.

* *Lepthyphantes tenuis* (Blackwall, 1852)
'Scarce' according to Bristowe, but during this survey found to be one of the commonest and most abundant species in the Garden, as it is throughout London.

Lepthyphantes zimmermanni Bertkau, 1890
A very common spider especially in London woodlands. 'Scarce' according to Bristowe, and during this survey also found to be scarce, but a few individuals were trapped on The Mound and by The Lake.

Lepthyphantes mengei Kulczinski, 1887
Not recorded by Bristowe; during this survey a few specimens were trapped on top of The Mound and by The Lake.

Lepthyphantes flavipes (Blackwall, 1854)
Not recorded by Bristowe, surprisingly; during this survey it was found commonly in most parts of the Garden.

Lepthyphantes ericaeus (Blackwall, 1853)
Not recorded by Bristowe; during this survey occasion specimens were found at all the pitfall sites and elsewhere among grass and other low vegetation.

Lepthyphantes pallidus (O.P.-Cambridge, 1876)
Not recorded by Bristowe; during this survey a few specimens were trapped on The Mound and by The Lake.

Linyphia triangularis (Clerck, 1757)
Not found by Bristowe, but together with the following four species was predicted to be present. During this survey, it was found on bushes, with its characteristic sheet-web, in various parts of the Garden. A few individuals were also trapped on The Mound.

Linyphia hortensis Sundevall, 1830
A few specimens trapped at both sites on The Mound.

Linyphia montana (Clerck, 1757)
Two specimens were trapped — by The Lake and on The Mound.

Linyphia clathrata Sundevall, 1830
Occasionally found in most parts of the Garden.

Linyphia peltata Wider, 1834
Two individuals trapped near The Lake.

PSEUDOSCORPIONES

Neobisiidae

(*Neobisium muscorum* (Leach, 1817))
A single specimen was collected from dead leaves by Bristowe.

Roncus lubricus L. Koch 1873
A single specimen was trapped in mossy grass on top of The Mound in January 1997. It is typically found in leaf-litter.

OPILIONES

Apart from *Leiobunum blackwalli*, all records of harvestmen were made by Colin Plant from the Malaise trap operating on The Mound or from his own pitfall traps, the positions of which are indicated in the map on pages 2 and 3. These were identified by Peter Harvey. Several samples from the Malaise trap remain unidentified at December 1999.

Phalangiidae

Paroligolophus agrestis (Meade, 1855)

Frequent in the Malaise trap samples between 22 September and 20 December 1995 and again from 15 August to 5 September 1996 and evidently common here.

* *Phalangium opilio* Linnaeus, 1758

This was the only harvestman recorded by Bristowe who noted it was 'common near The Lake'. During this survey specimens were found in the Malaise trap from 27 July to 20 November 1995 and then again from 15 August to 5 September 1996, with later samples still unsorted.

Opilio saxatilis C. L. Koch, 1839

A few were found in the Malaise trap sample for 27 July to 3 August 1995.

Leiobunidae

Dicranopalpus ramosus (Simon, 1909)

Several examples of this relatively scarce species were in the Malaise trap samples from 20 November to 20 December 1995 and for 20 December 1995 to 20 February 1996, though several further samples are still to be sorted.

Leiobunum rotundum (Latreille, 1798)

Quite frequent in Malaise samples for 27 July to 3 August and 15 August to 5 September, 1995.

Leiobunum blackwalli Meade, 1861

A few were swept from vegetation on The Mound by Colin Plant on 7 July 1995.

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References

BRISTOWE, W. S. 1964. Land invertebrates other than insects. In :McClintock, D. C., Richards, O. W. & Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963 (2): 48–54.

HILLYARD, P. D. & SANKEY, J. H. P. 1989. *Harvestmen*. Synopses of the British fauna (new series) No 4. E. J. Brill, Leiden.

LEGG, G. & JONES, R. E. 1988. *Pseudoscorpions*. Synopses of the British fauna (new series) No 40. E. J. Brill, Leiden.

MERRETT, P. 1990. *Review of the nationally notable spiders of Great Britain*. NCC contract survey number 127, Peterborough.

MERRETT, P., LOCKET, G.H. & MILLIDGE, A. F. 1985. A check list of British spiders. *Bull. Br. arachnol. Soc.* **6**(9): 381–403.

MERRETT. P. and MILLIDGE, A. F. 1992. Amendments to the check list of British spiders. *Bull. Br. arachnol. Soc.***9**(1): 4–9.

MILNER. J. E. D. 1987. Spiders in Alexandra Park 1984-1987. *Lond. Nat.* **66:** 111–124.

MILNER, J. E. D. 1993. Spiders and disturbance on Hampstead Heath and some other London grasslands. *Lond. Nat.* **72**: 85–99.

MILNER, J. E. D. 1995. Spider records for the London Area in 1994. *Lond. Nat.* **74**: 139–143.

MILNER, J. E. D. 1998. Spider records for the London Area in 1997. *Lond. Nat.* **77**: 147–148.

MILNER, J. E. D. (in press) Spiders in London: observations on their occurrence, phenology, habitat preference and response to disturbance from the results of 82 12-month pitfall samples. *Lond. Nat.*

NELLIST, D. R. 1998. SRS working list. *Newsl. of National Recording Scheme.* (cyclostyled) **31**: 1–3.

ROBERTS, M. J. 1985-1987. *The Spiders of Great Britain and Ireland, vols. 1–3.* Harley Books Colchester.

SAVORY, T. H. & LE GROS, A. E. 1957. The Arachnida of London. *Lond. Nat.* **36**: 41–50.

Collembola from Buckingham Palace Garden

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Abstract

Collembola were recorded from 1995 to 1997 at Buckingham Palace Garden. Five field visits were made in 1996 and 1997 and sampling was carried out by searching in likely places with a pooter and by collection and examination of soil and litter samples. Extraction from soil and litter samples was achieved using Tullgren funnels. Some material from a Malaise trap from 1995 was also examined. The total number of species recorded was 23, though this figure is approximate because of the uncertain taxonomy of some species. An earlier survey, in 1962 and 1963, recorded approximately 36 species of which six were not recorded in the present survey. The overall list for Buckingham Palace Garden from both surveys records a combined total of 42 species. The collembolan fauna for the Garden is discussed and is considered to remain under-recorded.

Summary of methodology

Three methods were used to retrieve Collembola from the Garden:

1 Active searching for Collembola and collecting the individuals with a pooter. The locations studied were those which appeared to be the most promising from previous experience of similar searches on other sites.

2 Removing samples of soil and other organic substrates, and placing these in Tullgren funnels. As before, the locations for each sample were those which appeared to be the most promising. The Tullgren funnels used were of a very simple design, relying on natural drying of the substrate without any artificial heat source being supplied. No data are available on how efficient these funnels are, although it is likely that only a percentage of the Collembola were extracted. It is possible that some species present in the samples were not extracted at all.

3 Samples from the Malaise trap, which operated in the Garden for the full length of the 1995–1997 survey were sorted by Colin Plant and these included some Collembola which were passed to me.

Results

The total number of individual collembolans found in the Malaise trap was 247, whilst 4,402 were collected from soil and litter samples. The total number of individuals found using the pooter was not recorded. Twenty-three species were found in total, of which twenty-two were extracted from the Tullgren funnels. Eight were found using the pooter, of which one was not found by the funnels, and just one species was found in the Malaise trap samples, this species being also found in the funnels and with the pooter. The totals should be taken as approximate because of the uncertain taxonomy of many of the species. In the species list I have indicated where, in my opinion, the taxonomy is in doubt.

Discussion

The Collembola of Buckingham Palace Garden were previously surveyed by Peter Lawrence in 1962 and 1963 (Lawrence 1964). That survey found approximately 6,000 Collembola of approximately 36 species. Tullgren funnels only were used in his survey and a total of 78 half-litre samples were examined. This gives a density, approximately, of 154 Collembola extracted per litre of soil and a species density of just under one species per litre. It is considered that the extraction funnels used by Lawrence were probably not 100 per cent efficient either.

In the present survey, the funnels produced 4,402 Collembola of about 22 species from 159 samples, each approximately one litre in volume. This gives a much lower density of approximately 28 Collembola extracted per one litre of substrate and a species density of only about 0.14 species per litre of substrate.

The difference in the number of Collembola specimens extracted was probably due principally to differences in the design of the funnels, though it is also possible that Lawrence took samples from more 'Collembola-rich' parts of the Garden. It is also possible that numbers of Collembola have declined since the original survey, either as part of the natural cycle or perhaps as a consequence of changes in climate.

The difference in the total number of species found by Tullgren extraction (36 in the earlier survey compared with 22 in the present study) is, however, much less and is likely to be a reflection of the much larger number of samples taken from a wider variety of habitats in the more-recent work.

Of the 36 species recorded by Lawrence, 18 are not represented in the present survey whilst of the 23 species I recorded, six were absent from the earlier work. This gives a combined total of 42 species. It is quite likely, however, that most of these species were present when both surveys were made and equally probable that neither sample covered all the species present.

At the time of writing there exists no proper record of the distribution of Collembola in Britain. No national check-list has been produced since Kloet and Hincks (1964). It is therefore not possible to provide any meaningful comparison of these records with sites elsewhere, although the combined total for both surveys of around 42 species is probably more than would normally be found in a completely natural environment of the same size.

In the previous survey, Lawrence recorded *Onychiurus sinensis* from the greenhouse; this species has been recorded elsewhere in Britain only from the Royal Botanic Gardens at Kew, Surrey. Where the greenhouse stood is now a car park. Samples from nearby soil and flowerpot humus (including in the new greenhouse a few yards away), have failed to produce any of this species and it is probable, therefore, that this species is now extinct in the Garden.

List of Collembola recorded from Buckingham Palace Garden

For species recorded in the present survey information on the extraction method is given, followed by the grid squares in which the species was found. Extraction/collection methods are abbreviated as follows:

t = Tullgren funnel
p = pooter
m = Malaise trap

Thus, a species extracted by Tullgren funnel from grid square E5 is annotated t-E5. For interpretation of the grid squares refer to the main map in this *Supplement*.

?? indicates an uncertain taxonomy, rendering the given identification tentative.

Taxa recorded in the earlier survey (Lawrence 1964), but not during the current project, are included in the species list in parentheses. Taxa recorded in both surveys are annotated with an asterisk. Remaining taxa were recorded in the 1995–1997 survey only.

COLLEMBOLA

(**Hypogastruridae**)

(*Hypogastrura denticulata* Bagnall).

(*Hypogastrura gibbosa* Bagnall).

(*Hypogastrura manubialis* group ??) The taxonomy of this group is uncertain. See Christiansen (1998).

(*Xenylla grisea* group ??) The taxonomy of this group is uncertain.
(*Friesea mirabilis* Tullberg).
(*Brachystomella parvula* Schäffer).

(**Anuridae**)
(*Anurida pygmaea* Börner).

Neanuridae
⋆ *Neanura muscorum* (Templeton) 10.ii.1997 (t) and 10.iii.1997 (t).

(**Onychiuridae**)
(*Onychiurus armatus* group ??). The taxonomy of the *O. armatus* group is uncertain. See Pitkin (1979, 1980) and Lawrence (1979).
(*Onychiurus sinensis* Stach ??).
(*Tullbergia catlipygos* Börner).
(*Tullbergia krausbaueri* Börner).

Isotomidae
(*Folsomia candida* group).
Folsomia candida (Willem) ?? 10.iii.1997.
Folsomia fimetaroides (Axelson) 10.iii.1997 (t). A specimen keying down to this species was found on 10 January 1997. The general dimensions of the furca did not agree with the norm for *F. fimetaroides* and this may be an aberrant member of a different species.
(*Folsomia garretti* Bagnall) ?? 1962–3.
Folsomia manolachei (Bagnall) 3.vii.1996 (t-E5).
⋆ *Folsomia penicula* (Bagnall) ?? 3.vii.1996 (t-E5).
(*Folsomia quadioculata* Tullberg 1962–3). ?? A the time of the previous survey the distinction between *F. quadioculata* and *F. manolachei* is less clear than it is now. It is possible that the specimens named as *F. quadioculata* were, in fact, *F. manolachei* (Wetton 1987) and Devarveng (1982).
Folsomia similis (Bagnall) 10.iii.1997 (t).
(*Proisotoma minima* Absolon).
⋆ *Proisotoma minuta* (Tullberg) 3.vii.1996 (t-A2). This species was found in the compost heap.
⋆ *Isotoma notabilis* (Schäffer) 3.vii.1996 (t-H8, G10),18.xi.1996 (t-A2). Specimens probably belonging to this species were found in many other squares.
(*Isotoma olivacea-violacea* group 1962–3).
Isotoma olivacea (Tullberg) 18.xi.1996 ?? (t-A2). Taxonomy of the *Isotoma olivacea-violacea* group is uncertain. See Fjellberg (1979) and Leinaas (1980).
⋆ *Isotoma viridus* (Bourlet) ?? 18.xi.1996 (t-C1). It is unclear whether there are two good species *I. viridus* and *I. anglicana* or just one species *I. viridus*. (Pomorski 1988).
(*Isotoma sensibilis*, Tullberg 1962–3).
(*Isotomurus palustris* (Müller) 1962–3).
Isotomurus palustris (Müller).
var. *palustris* (Müller) 26.iv.1996 (p-H7).
var. *maculatus* (Schäffer) - 26.iv.1996 (p-H7),3.vii.1996 (t-H8).
Both varieties were found on the shores of the lake.

Entomobryidae
⋆ *Entomobrya albocincta* (Templeton) 3.vii.1996 (p-D6, J7). Found on ground under logs and cardboard. This species is usually found on bark.
⋆ *Entomobrya multifasciata* (Tullberg) ?? 26.iv.1996 (p-G10, E6) 3.vii.1996 (t-H10, J10). This may be a good species or a variety of *E. nivalis*. See South (1961). Found on ground in litter. Found in many other squares.
⋆ *Entomobrya nivalis* (Linn.) 24.iv.1996 (p-E6) 3.vii.1996 (t-E5, H10, F7), 20.xii.1995 (m, M9). This species was found on the ground using the pooter, but not as abundantly as *E. multifasiciata*. This species was the only one found in the Malaise trap.
(*Lepidocyrtus cyaneus* (Tullberg) (1962–3)).
Lepidocyrtus lignorum (Fabricius) ?? 10.ii.1997 (t-N9). Distinction from *Lepidocyrtus lanuginosus* (Gmelin) is unclear and they may be different varieties of the same species.

⋆ *Psuedosinella alba* (Packard) 18.xi.1996 (t-A2). One specimen was found in the compost heap. Individuals probably belonging to this species were found in many other squares.

⋆ *Heteromurus nitidus* (Templeton) 3.vii.1996 (t-H10, G10, F2) 18.xi.1996 (t-F1). Individuals probably belonging to this species were found in litter in many other squares.

Orchesella cincta (L.) 26.iv.1996 (p-E6, G10) 3.vii.1996 (p-H10)(t-E5, J7, G6), 10.ii.1997 (t-C2), 10.iii.1997 (t-OI, H1).

⋆ *Orchesella villosa* (Geoffroy) 3.vii.1996 (t-H10, J10),18.xi.1996 (p-F2, G10) 10.ii.1997 (t-N9, C2, L11).

Tomoceridae

(*Tomocerus minor* Lubbock 1962–3).

Tomocerus vulgaris (Tullberg) 24.iv.1996 (p-E6),3.vii.1996 (p-H10).

Neelidae

(*Neelus minimus* Willem 1962–3).

Sminthuridae

(*Sminthurides minimus* Krausberg 1962–3).

(*Sminthurides pumilis* Krausbauer).

⋆ *Sminthurinus elegans* (Fitch) ?? 3.vii.1996 (t-H8) .

⋆ *Sminthurinus aureus* (Lubbock) 10.ii.1997 (d, F11).

(*Sminthurinus niger* (Lubbock) 1962–3).

Dicyrtomidae

Dicrytoma saundersi (Lubbock) 10.ii.1997 (t-C1).

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References

CHRISTIANSEN, K. 1998. *The Collembola of North America north of the Rio Grande. A taxonomic analysis.* Grinnell College, Grinnell, Iowa. 1–1322.

DEHARVENG, L. 1982. A Propos des *Folsomia* du group *quadrioculata* Tullberg, 1871. *Revue Ecol. Biol. Sol.* **19** (4): 613–627.

FJELLBERG, A. 1979. Revision of the European species in the *Isotoma olivacea* group (Collembola: Isotomidae) *Ent. Scand.* **10**(2):91–108.

GISIN, H. 1947. Le Group Entomobrya nivalis. *Mitt. schweiz. ent. Ges.* **20**: 541–550.

KLOET, G.S. and HINCKS, W.D. 1964. A check list of British insects. 2nd Edition. Part 1: Small Orders and Hemiptera. *Handbks Ident. Br. Insects.* **1**: 4–11.

LAWRENCE, P.N. 1979. Observations on the taxonomy and ecology of *Onychiurus armatus* (Collembola: Onychiuridae). *Revue Ecol. Biol. Sol.* **16**(2): 259–277.

LAWRENCE, P.N. 1964. *Collembola.* In McClintock, D.C., Richards, O.W. and Knight, M. Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963: 76–77.

LEINAAS, H.P. 1980. *Isotoma blekeni* n. sp. (Collembola: Isotomidae) from coniferous forest in Norway. Ecological segregation of related, coexisting species. *Revue Ecol. Biol. Sol.* **17**(2): 281–289.

PITKIN, B.R. 1979. *Studies on the British species of the* Onychiurus armatus *group (Collembola:Onychiuridae).* Central London Polytechnic, London, 1–126.

PITKIN, B.R. 1980. Variation in some British material of the *Onychiurus armatus* group (Collembola). *Systematic Entomology* **5** (4) 405–426.

POMORSKI, R.J. 1988. *Ceratophysella succinea* (Gisin, 1949) and *Isotoma anglicana* Lubbock, 1862 — interesting species of Collembola from the sugar beet fields of Lower Silesia (Poland). *Przegl. Zool.* **32**(1) 1988: 51–54.

SOUTH, A. 1961. The taxonomy of the British species of *Entomobrya* (Collembola). *Trans. R. ent. Soc. Lond.* **113**: 387–416.

WETTON, M.N. 1987. Morphological variation in British *Folsomia quadrioculata* Tullberg (Collembola, Isotomidae); a multivariate study. *Systematic Entomology* **12**: 257–270.

PLATE C. Buckingham Palace Garden, London. View from Mudhole towards No. 1 bridge, June 1998.

Photographed by Mark Lane.

PLATE D. Buckingham Palace Garden, London. The Robinson-pattern moth trap in situ on top of The Mound, June 1998. *Photographed by Mark Lane.*

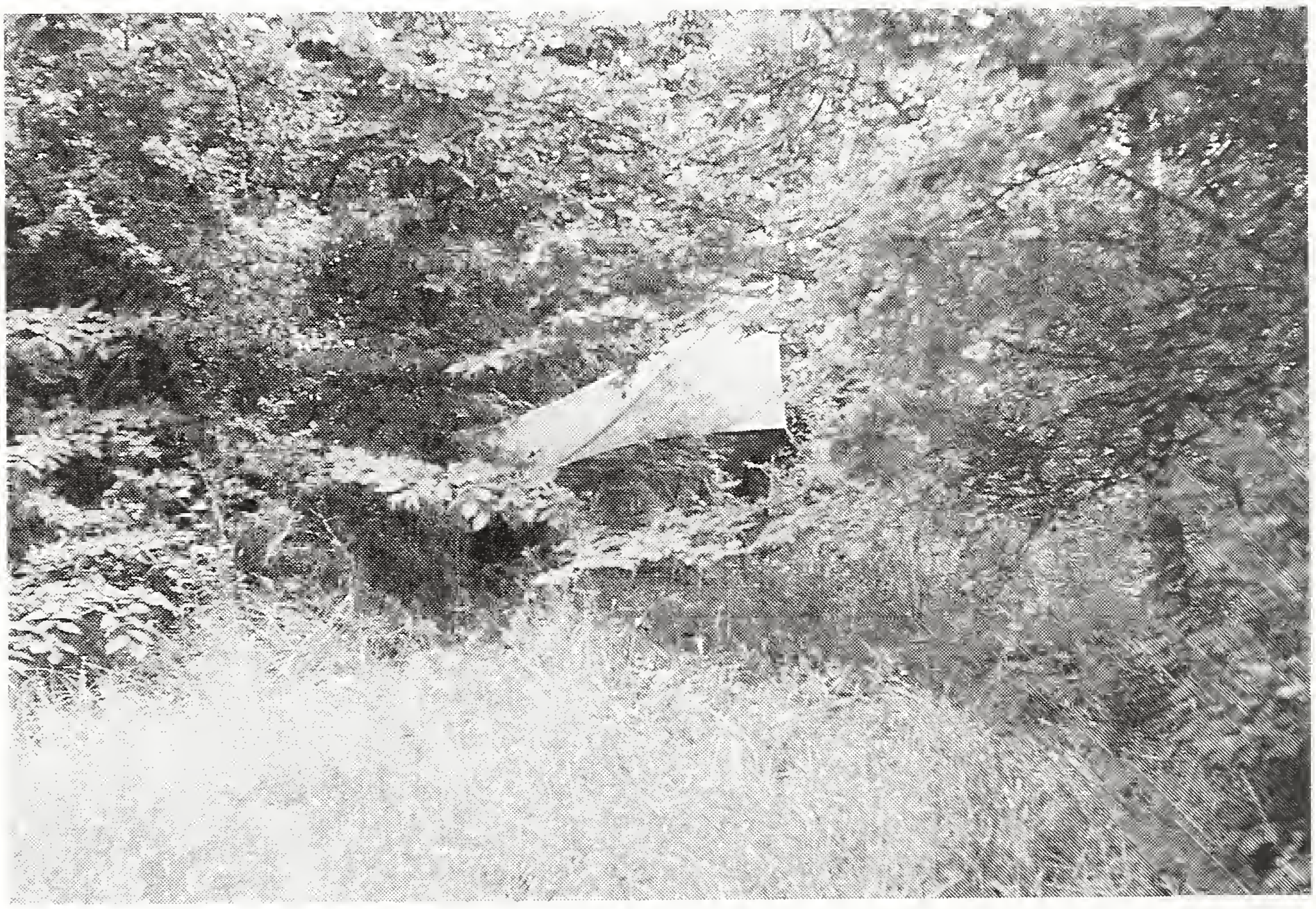

PLATE E. Buckingham Palace Garden, London. The Malaise trap, in situ on The Mound, June 1998. *Photographed by Mark Lane.*

The natural history of Buckingham Palace Garden, London.
Part 1

Supplement to *The London Naturalist* No. 78

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